

STEALTH SPECIAL

EXCLUSIVE

- *Going to War in the F-117*
- *What Makes the B-2 Stealthy*
- *Return of the Raptors*
- *Early Days*



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Cover photos (main): **A USAF F-117A Nighthawk.** Rich Cooper/COAP. Inset (bottom left): **Aer Lingus Boeing 757-200, EI-LBT.** Aer Lingus. Inset (bottom right): **Turbo Caribou N238PT just prior to touching down at Girona in Spain.** AirTeamImages.com/Jarvi Sanchez Utzet

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Printed in England by Warners (Midland) plc, Bourne, Lincolnshire. (ISSN 2047-7198). The entire contents of AVIATION NEWS INCORPORATING JETS is a copyright of Key Publishing Ltd, and can not be reproduced in any form without permission.

Maiden Flight for A330neo



The A330neo on its first flight. (c) Airbus 2017 - photo by S Ramadier

The first of three A330neo Family development aircraft to fly – F-WTTN MSN1795, an A330-900 variant – has successfully completed its first flight lasting 4hrs and 13mins. The aircraft was powered by the latest technology Rolls-Royce Trent 7000 turbofans. The crew in the cockpit were Experimental Test Pilots Thierry Bourges, Thomas Wilhelm and Test Flight Engineer Alain Pourchet.

Fabrice Brégier, Airbus COO and President of Airbus Commercial Aircraft, said the flight marked another milestone

along the company's "journey of continuous innovation".

Airbus has a fast-paced development programme from launch to first A330neo delivery. This will comprise 1,100 flight hours for the A330-900 campaign – to achieve its EASA and FAA Type Certification around the middle of next year.

An additional 300 flight hours is also allocated for the A330-800's own certification flight-test programme – the start date has not yet been announced. These trials will be performed in an "airline

like" environment, ensuring maximum aircraft maturity and reliability at entry into service (EIS) with A330-900 launch operator TAP Portugal.

Launched in July 2014, the A330neo is the latest generation in the Airbus A330 product line, comprising two versions: the A330-800 and A330-900.

The larger -900 will have 287 seats in a typical three-class layout, while the -800 can seat 257 passengers in three classes.

To date, 12 customers have placed orders for a total of 212 A330neos.

First Qantas Dreamliner



Qantas, has unveiled its first Boeing 787-9 Dreamliner, VH-ZNA (c/n 39038) – the jet, named *Great Southern Land*, arriving at the carrier's Sydney base on October 20.

Qantas intends to use the eight new aircraft, which will all be delivered by the end of 2018, on services from Melbourne to Los Angeles, and Perth to London, enabling the oneworld alliance member to retire five Boeing 747s.

Alan Joyce, Qantas Group CEO, said: "Taking delivery of a new type of aircraft is always an important milestone for an airline and the 787 is a game-changer. From the distance it's able to fly, to the attention to detail we've

The first Boeing 787-9 Dreamliner for Qantas. Qantas

put into the cabin design, it will reshape what people come to expect from international travel.

"The Dreamliner makes routes like Perth to London possible, which will be the first direct air link Australia has ever had with Europe. And it means other potential routes are now on the drawing board as well."

The airline collaborated with Australian industrial designer David Caon on the interior design of the Dreamliner. Caon had worked with Qantas on previous cabin upgrades as well as its lounges in Singapore and Hong Kong.

Delay in Move from Mildenhall

The USAF's 100th Refueling Wing's move from RAF Mildenhall, Suffolk, to Ramstein AB, Germany, has been delayed until 2024. The closure of Mildenhall, facilities at RAF Alconbury and RAF Molesworth in Cambridgeshire and 12 other installations across Europe was announced as part of a European Infrastructure Consolidation in January 2015, and was expected to save around \$500m annually. It was to be effective from 2022.

A spokesman for US Air Forces in Europe-Air Forces Africa told *Stars and Stripes* the move from Mildenhall has been put back due to discussions between the US and Germany relating to "program management, procedures and responsibilities". The 24-month delay also applies to Alconbury and Molesworth.

As part of the plan, the special operations forces assigned to the 352nd Special Operations Wing will move to Spangdahlem AB, Germany.

USAF F-35As Deploy to Japan

The F-35As first official operational overseas deployment will be to Japan, the USAF announced on October 23. Around 300 personnel and 12 Lightning IIs from Hill AFB, Utah's 34th Fighter Squadron (FS) were scheduled to arrive at Kadena AB, Japan in early November. They will remain there for a six-month rotation in the US Pacific Command's (PACAF's) first operational tasking for the F-35A.

US Marine Corps F-35Bs have been based at Marine Corps Air Station Iwakuni, Japan since January.

In related news, F-35A pilots continue to report hypoxia-like (lack of oxygen) symptoms. Five such physiological episodes (PEs) have been noted after flying resumed, following a fleet grounding at Luke this summer.



A 34th FS F-35A Lightning II on approach to Joint Base Pearl Harbor-Hickam on October 30. One of 12, participating in a US Pacific Command's theater security package (TSP), which stopped off in Hawaii en route to Japan. USAF/Tech Sgt Heather Redman

As of mid-October, a total of ten such incidents had been reported for the year. As part of a continuing investigation, the

F-35 Joint Program Office has examined the aircraft's on-board oxygen generation system (OBOGS), but found no problems.

Airbus and Bombardier C Series Deal

Bombardier's C Series aircraft programme is now set to be produced as a joint venture with Airbus. The announcement on October 16 is, the Canadian plane maker, said, a "strategic" decision and follows its unsuccessful attempt to form a partnership with Airbus in 2015. The European manufacturer will take a 50.01% majority stake in C Series Aircraft Limited Partnership (CSALP), while Bombardier will own just under 31% (previously 62%)

and Investissement Québec (an agency of the Government of Québec) 19% (38%). A second Final Assembly Line will be set up in Mobile, Alabama for US customers.

Alain Bellemare, Bombardier's President and CEO remarked: "We are doing this deal here not because of the Boeing petition [claiming it received unfair subsidies], we are doing it because it is a strategic move for Bombardier."

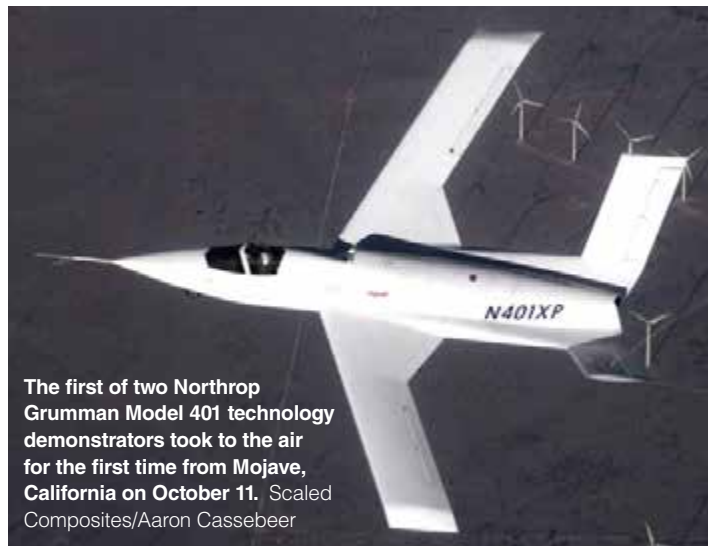
The US Department of Commerce

upheld Boeing's claim and proposed trade duties of 300% on Canadian-manufactured C Series aircraft imported into the US.

For Bombardier's Northern Ireland factory, which builds the aircraft's wings, the deal has been described as "great news" and could help to secure 1,000 engineers working on the programme.

Airbus says it will provide procurement, sales and marketing as well as customer support expertise to CSALP.

Model 401 Gets Airborne



The first of two Northrop Grumman Model 401 technology demonstrators took to the air for the first time from Mojave, California on October 11. Scaled Composites/Aaron Cassebeer

Model 401, an experimental aircraft from Northrop Grumman's Scaled Composites subsidiary, made its first flight from Mojave, California, on October 11. The aircraft is one of two prototypes built for an unspecified 'proprietary customer' and is intended as a demonstrator for low-cost manufacturing techniques.

The single-seat Model 401 is powered by a single 3,045lb st (13.55kN) Pratt & Whitney Canada JT15D-15D-5D turbofan and features a dorsal inlet and V-tail.

The aircraft is 38ft (11.58m) long with an identical wingspan, has an empty weight of 4,000lb (1,814kg) and maximum take-off weight of 8,000lb (3,629kg). It has a maximum speed of Mach 0.6 and altitude of 30,000ft and an endurance of three hours.

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Two HALOs at Mildenhall



Two unusual G-1159B Gulfstream IIBs arrived at RAF Mildenhall from the US on October 9 to participate in Exercise Formidable Shield. Each has a large dorsal fairing, installed above the forward fuselage, for the High-Altitude Observatory (HALO) programme.

The fairing contains various sensors including a telescope developed by Aeromet, a division of L3 Communications.

One aircraft, N178B (c/n 125) known as HALO-II, is assigned to the Missile Defense Agency, but operated by L3 Aeromet at Tulsa, Oklahoma. The other, N779LC (c/n 88) is called HALO-IV and is registered to L3 Communications Flight Capital, of Newport News, Virginia. The airborne observatories reportedly offer excellent performance,

Gulfstream IIB, HALO-IV, N779LC at RAF Mildenhall. Dino Carrara

adaptability and endurance for their roles, flying at very high altitude, above obscuring clouds and atmosphere distortion. The electro-optical/infrared sensors mounted in the pod on top of the fuselage, enable excellent azimuth field of regard (FOR) and horizon-to-horizon elevation viewing.

Exercise Formidable Shield also involved four 31st FW F-16CMs from Aviano AB, Italy, which were operated from RAF Lossiemouth. The exercise was said to be one of the most sophisticated and complex of its type ever undertaken in the UK, with the live component conducted to test NATO integrated air and ballistic

missile defence capabilities.

The F-16s were flown as launch platforms for the Beechcraft AQM-37 Jayhawk supersonic target drones, which simulate inbound ICBM warhead packages during maritime shoot-down exercises.

Ships, including a Royal Navy Type 45 Destroyer and two Type 23 Frigates took part along with vessels from Canada, France, Germany, Italy, the Netherlands, Spain, and the US. They participated in the live-firing integrated air and missile defence scenarios, defending against anti-shipping cruise missiles.

Formidable Shield ran from September 24 to October 18 in waters off the west coast of Scotland. **Bob Archer**

Coningsby Bids Farewell to the Tornado



The final two Tornado GR4s operated by 41(R) Test and Evaluation Squadron, ZA560 'EB-Q' and ZA607 'EB-X', flying over Lincolnshire during one of their last sorties. Crown Copyright/RAF Leeming SAC Parkinson

RAF Coningsby, Lincolnshire, has ended an association with the Tornado that has lasted on and off for 33 years.

The last two GR4s operated by 41 (Reserve) Test and Evaluation Squadron have carried out their final missions. The aircraft were ZA560 'EB-Q' and ZA607 'EB-X'.

Tornado ZA560 took part in the static display during the week-long Air Combat Power Visit, which began on October 21. It left for Marham on October 30. While ZA607 was still at Coningsby when we went to press on November 6.

The squadron now has an all-Typhoon fleet at Coningsby.

RAF 100th Birthday Events

A series of key public events will mark the 100th anniversary of the RAF next year. An opening concert at the Royal Albert Hall, London, on March 31 begins the celebrations which conclude with a Battle of Britain Service in the capital on September 16. A National Aircraft Tour will be staged at Cardiff City Hall Gardens from May 16 to 20; Horse Guards Parade, London from July 6 to 9; Newcastle, Northern Ireland on August 4 and 5; Victoria Square, Birmingham from August 25 to 27; Glasgow Science Centre on September 1 and 2, and Cathedral Gardens, Manchester on September 15 and 16.

Other national events include the RAF Cosford Airshow on June 10, RIAT at RAF Fairford from July 13 to 15 and the Northern Ireland Airshow at Portrush on August 4 and 5. There will be an RAF 100 Parade and Flypast at The Mall, London, on July 10. There is an official reopening ceremony for the RAF Museum in London on June 21. Work to radically alter the museum site with changes to the exterior, interior, and the exhibits, are designed to bring the history of the air arm up to the present day and give the facility (at the former RAF Hendon) a contemporary feel.

Indonesian F-16s on Exercise in Australia

The Tentara Nasional Indonesia – Angkatan Udara (TNI-AU, Indonesian Air Force) sent six F-16C/Ds from Skadron Udara 3 at Lanud Iswahyudi, Madiun, Java, to Royal Australian Air Force (RAAF) Base Darwin, Northern Territory, to take part in Exercise Elang Ausindo 17 from October 16 to 27. Support was provided by a TNI-AU C-130 Hercules. The bilateral training exercise between Australia and Indonesia, held regularly since 1995, was previously hosted by RAAF Base Darwin in 2009 and 2013.

Eight F/A-18A Hornets for the RAAF's 75 Squadron at RAAF Base Tindal, Northern Territory, were also deployed to Darwin to participate in the exercise, which is designed to enhance, develop and promote



Skadron Udara 3 F-16C TS-1632 taxis out at RAAF Base Darwin on October 18 to fly a joint mission with RAAF 75 Squadron F/A-18As during Exercise Elang Ausindo 17. SGT Rob Hack/ Commonwealth of Australia

international engagement between the RAAF and TNI-AU. Missions included one-on-one and multiple dissimilar air combat

engagements, taking place largely off the coast to minimise the environmental impact on residents. **Dave Allport**

ATAC Buys French Fighters

The Airborne Tactical Advantage Company (ATAC) has purchased 63 Mirage F1 fighters from France, along with support equipment and 150 engines.

Textron, the new owner of ATAC, will pitch the Mirages when it bids for the USAF's forthcoming Adversary Air (ADAIR) contract, which calls for almost 150 aircraft to fulfil the service's Red Air training needs.

Textron is planning to retrofit around 45 of the F1s with modern avionics systems and upgraded radars.

The adversary programme, which is intended to provide the USAF with up to 40,000 flight hours, will support the USAF's Weapons School and Red Flag training events, along with operational test and evaluation missions at Nellis AFB, Nevada, and training at numerous other facilities.

The USAF expects to release a final request for proposals in January 2018, with a contract award in 2019.

Several other companies are expected to respond to the USAF request.

Greece Plans Fighting Falcon Upgrade

An upgrade of Greece's F-16 fleet is planned. The US Government has approved a potential deal that could be worth \$2.4bn. It would bring the Hellenic Air Force's 123 in-service Fighting Falcons to the latest F-16V standard.

The improvements include up to 125 AN/APG-83 active electronically scanned array (AESA) radars, plus Modular Mission Computers (MMCs), Link 16 Multifunctional Information Distribution System Joint Tactical Radio Systems (MIDS-JTRS), embedded GPS/inertial navigation systems (INS) and APX-126 Advanced Identification Friend or Foe (AIFF) systems.

Greece currently employs a mix of F-16s in Block 30, Block 50, Block 52+, and Block 52+ Advanced configurations.

New Surion Appears at Seoul Show



A new version of the KUH-1 Surion for the Republic of Korea Marine Corps (ROKMC) was publicly demonstrated at the International Aerospace & Defense Exhibition (ADEX) at Seoul from October 17 to 22. Korea Aerospace Industries received a contract last year to build Surions for the ROKMC over a three-year period. The marines have a total

The new KUH-1 Surion for the South Korean Marine Corps was shown for the first time in October. Gordon Arthur

requirement for 40 helicopters, but the initial contract, it has been reported, is for 28 units. Production started earlier this year and the first will be handed over to the marines in December. **Gordon Arthur**

Ghostrider Achieves IOC

The AC-130J Ghostrider gunship achieved initial operating capability (IOC) on September 30.

The Air Force Special Operations Command's 1st Special Operations Group has received six Ghostriders and a training centre has been activated. It is thought unlikely the new gunship will be deployed to a combat zone for two years.

The service has converted, or begun conversion, of ten MC-130Js to the AC-130J configuration. The first Block 20 AC-130J was delivered last July. The Ghostrider is scheduled to achieve full operational capability in 2023 when the last of 37 examples has entered service.

Serbian MiGs Handed Over



Six MiG fighters were officially handed over to Serbia by Russia during ceremonies to mark the 73rd anniversary of the capital Belgrade being liberated from Nazi Germany.

At Batajnica Air Base, five out of six former Russian Air Force MiG-29s comprising one *Fulcrum-A* (serial number 18151), two *Fulcrum-Cs* (18202 and 18203) and two *Fulcrum-UBs* (18351 and 18352) were passed to the Serbian Air Force in the presence of Serbian president, Aleksandar Vučić and Russian Defence Minister Sergéy Kuzhugétovich Shoygú.

Russian MiGs were handed over to Serbia during events to mark the liberation of Belgrade in 1944. Babak Taghvaaee

The aircraft were built between 1989 and 1991. The sixth MiG-29, which is another *Fulcrum-C* (18201), is in Russia and will be overhauled at the 121st Aircraft Repair Plant in Kubinka. The six MiG-29s will not be operational until they have been upgraded to Serbian Air Force standards by June next year. At that time, three currently airworthy MiG-29B/UBs will be grounded for overhaul.

Babak Taghvaaee

Eagles to get Legion Pod

Boeing and the USAF have selected Lockheed Martin's Legion Pod Infrared Search and Track (IRST) system for the F-15C fleet.

Plans call for the acquisition of 130 systems, with initial operational capability being achieved in 2020. Boeing, which serves as the USAF's prime contractor for the F-15, will initially award Lockheed Martin an engineering, manufacturing, development and production contract and the first pods will be delivered in 2018.

Based on the IRST21, which was developed for the US Navy, the pod features the same sensor that is being integrated with the F/A-18E/F.

Uncertainly over Fiscal Year 2018 defence funding could delay the start of the project.

Argentine Super Étendards to Fly Again

Five former French Navy Super Étendard Modernisé (SEM) fighters will be transferred to the Comando de Aviación Naval Argentina (COAN, Argentine Naval Aviation Command) for use as a spares source.

The jets will be provided with powerplants installed and another ten engines will be delivered as part of a spares package of 9,000 items. A flight simulator and test benches for calibration and maintenance are also included.

The COAN's fleet of 11 surviving Super Étendards has been stored for the last three years, and the spare parts from France will be used to bring them back to service. **Juan Carlos Cicales**

B-21A Bomber Review

A Preliminary Design Review by the USAF and Northrop Grumman has been completed for the B-21A Raider bomber programme.

The milestone occurred just 19 months after the contract for the new bomber was awarded. The B-21A design team is integrating mature technologies on the bomber and "leveraging lessons learned" from the B-2, F-22, and F-35 programmes.

Kiowa Warrior's Last Flight

The US Army's final Kiowa Warrior flight took place at Felker Army Airfield, Virginia, on September 19. The last operational Bell OH-58D was retired last year but a single example was retained by the Aviation Development Directorate at Joint Base Langley-Eustis, Virginia. It was this helicopter, carrying the serial number 90-00373, which ended an era that can be traced back to the 1960s.

AC-208s for Afghanistan

Up to four Cessna AC-208II Armed Caravan aircraft will be delivered to Afghanistan by Orbital ATK under the terms of a \$69.4m contract awarded by the US Air Force's 645th Aeronautical Systems Group in September.

The armed intelligence, surveillance and reconnaissance (ISR) aircraft are equipped with high-definition electro-optical/infra-red (EO/IR) sensors with integrated laser designator. Its reconfigurable weapons fit enables it to carry four laser-guided Hellfire missile launchers under each wing or single 2.75in (70mm) rocket pods for Advanced Precision Kill Weapon System (APKWS), or other guided rockets.

Tom Kaminski

Colombian Kfirs New Weapon



A Colombian Air Force Kfir carrying Rafael I-Derby missiles. Cess-Jan van der Ende

The Colombian Air Force is arming six Kfirs with at least six Rafael I-Derby ER air-to-air missiles purchased from Israel. More are due

to be bought from the 2018 budget, providing an initial total of 16 in the inventory, after a contract for their acquisition was signed in January.



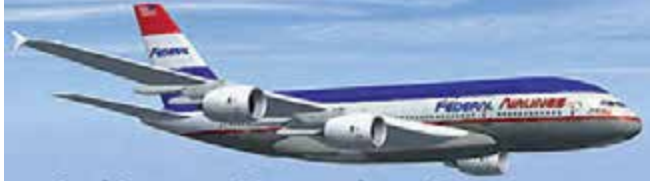
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Aero 2018 [Limited seats]	13th Apr - 21st Apr
US East Coast	21st Apr - 27th Apr
Spain - Portugal [Limited seats]	13th May - 22nd May
Lisbon W/E	18th May - 20th May
UK Tour	26th May - 28th May
Canada Coast to Coast [Limited seats]	9th June - 25th June
Alaska [Limited seats]	23rd June - 2nd July
Citations Airlift	23rd June - 2nd July
Oshkosh [Limited seats]	21st July - 31st July
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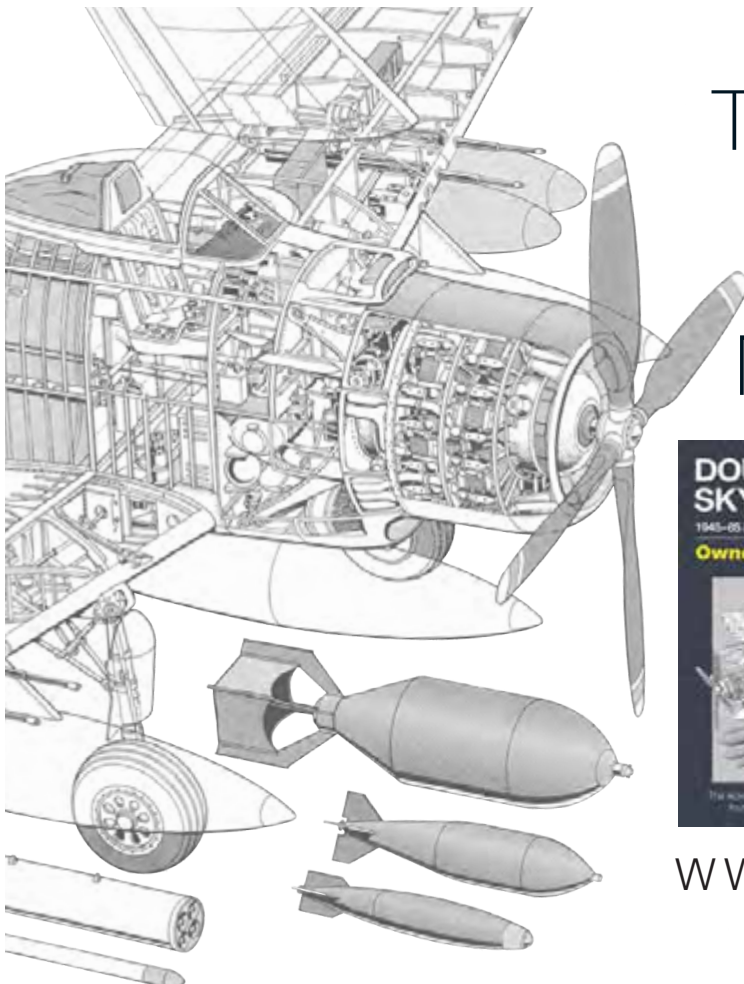


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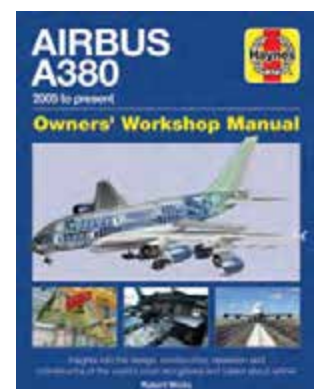
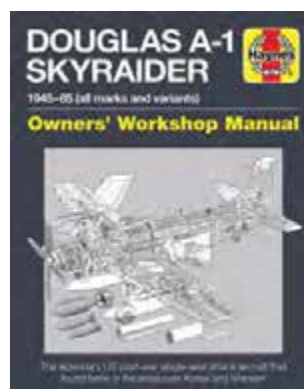
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Super Tucanos for Lebanon



Two A-29A Super Tucanos arrived at Hamat AB in northern Lebanon following a ferry flight from the US on October 9. Lebanese pilots and maintenance personnel began training to fly and service the aircraft at Moody AFB, Georgia, in March. An additional four A-29As are expected to arrive in Lebanon over the next 12 months.

Separately, Embraer announced on

Embraer A-29A Super Tucano 15-2021 in USAF markings passing through Glasgow Prestwick Airport on October 5 on a short refuelling stop en route to the Lebanese Air Force. A second aircraft, 15-2022, also made a similar stop in Scotland. Stephen Brennan

October 16 that an undisclosed customer had placed an order for six A-29 Super Tucano. Deliveries will be completed in 2018.

Romanian F-16 Order Complete

The Romanian Air Force order for 12 F-16s has been completed. Three aircraft passed through Aviano AB, Italy, on September 28, on delivery from Portugal to Romania. The aircraft were taken from the 309th Aerospace Maintenance and Regeneration Group (AMARG) in the United States and upgraded to MLU standard in Portugal.

Panama's Second Twin Otter

A second Series 400 Twin Otter has been ordered by Panama from Viking Air for its National Aeronaval Service's (SENAN) Air Group. The aircraft is scheduled for delivery to Tocumen International Airport/Captain Juan Delgado Air Base in December, and will support the agency's humanitarian aid missions throughout the country. It will join the first Viking Series 400, delivered in December last year.

Tom Kaminski

Trainer Competition Delayed

The US contract for the T-X trainer competition to replace the T-38 Talon is now likely to be awarded in the spring. Plans originally called for an announcement before the end of this year.

The news is no great surprise, given

that Air Force Secretary Heather Wilson had warned that the USAF would be unable to move ahead on new projects if the Continuing Resolution, which prohibits awarding new program contracts unless Congress approves specific funding, was

still in place.

The USAF has also said it needs more time to evaluate additional information from the competing vendors. There is a requirement to supply 350 new trainers for the USAF.

ROCAF Tracker Flies On

The last Taiwanese S-2T Tracker was reportedly withdrawn earlier this year, but an existing example is now set to retire on December 1. The extension is due to a delay in getting the P-3C Orions operational,

according to the Republic of China Air Force (ROCAF). On May 18, Tracker 2214 had departed from the Pingtung AB for Hsinchu AB for what was said to be the final flight. Operated by the 34th Anti-Submarine

Squadron at Pingtung, it was to be preserved at Hsinchu. Aircraft 2220 took part in the flying display during at the Hualien AB Open House on September 24 to commemorate the 80th anniversary of the air force. **Mark Rourke**

F-35B Cleared for Carrier

Successful trials have cleared F-35Bs to use the 'ski-jump' fitted to the flight deck of the Royal Navy's two new aircraft carriers. The tests were undertaken at NAS Patuxent River, Maryland.

Next year the aircraft will perform trials from the deck of HMS *Queen Elizabeth*.

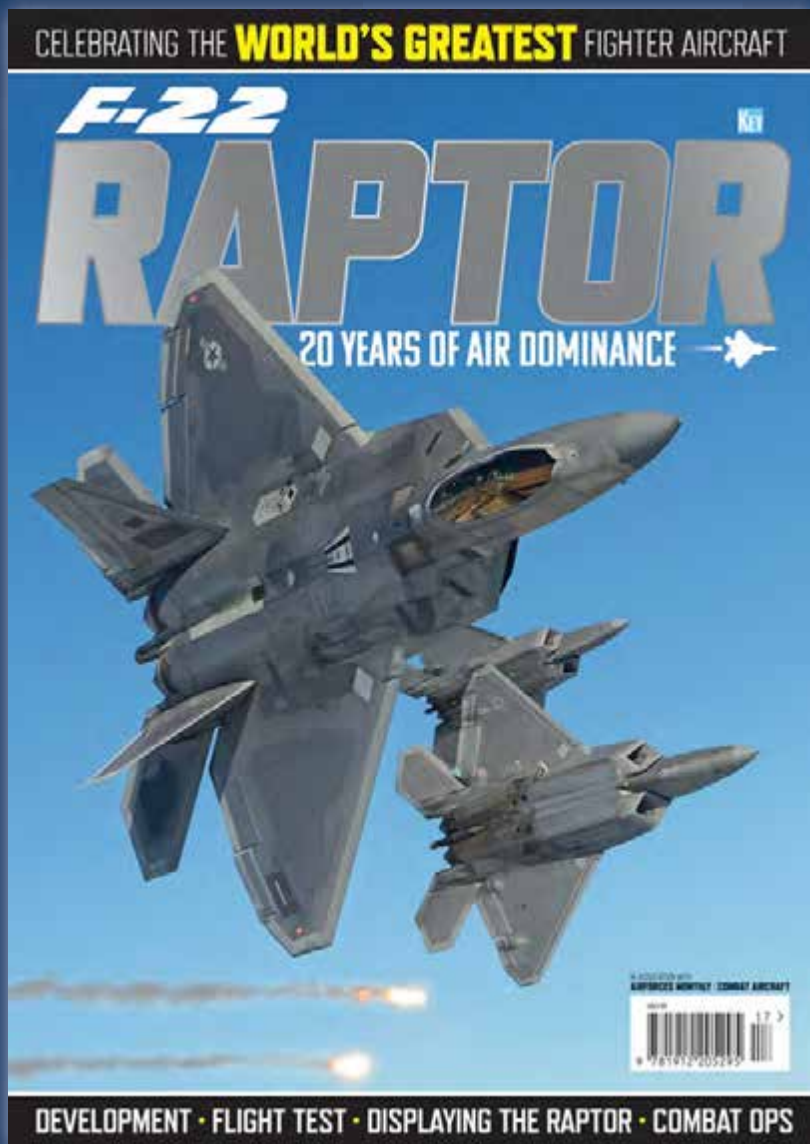
Lockheed Martin has been awarded an \$11.56m delivery order to provide support for first-of-class flying trials and the release of the military permit to fly for F-35B to operate from the British carriers.

Hinds for Mali



Mali received two Russian Helicopters' Mi-35M assault/attack helicopters in early October. The helicopters were completed under a contract signed with Russian state arms exporter Rosoboronexport. *Presidence Mali*

20 YEARS OF AIR DOMINANCE



F-22 RAPTOR

The first F-22A Raptor took to the skies on September 7, 1997. It is a stealthy, supercruising, sensor-fused master of the skies. Unlike the F-15 Eagle, the F-22 hasn't been in an air-to-air shooting war. Some would argue that this is testament to its prowess; that others have chosen to remain on the ground, rather than risk tangling with a Raptor. Talk to any fighter pilot and you'll soon realise that nothing comes close to a Raptor. In this special publication, we mark 20 years since the first flight of this incredible fighter jet.



1004/17



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Thai Lion Air's First A330



A new phase of rapid expansion is under way for Thai Lion Air. It was due to take delivery of this, its first widebody aircraft, in November. The jet, HS-LAH (c/n 1820), is the first of three Airbus A330-300s the carrier will operate on new medium-haul routes to northern Asian destinations. Eurospot

Russian Regional Airliner Project

Plans for a new 19-seat turboprop regional airliner have been revealed by the Siberian Aeronautical Research Institute (SibNIA). According to *Russian Aviation Insider*, details of the programme were outlined for the first time by Dmitry Smirnov, head

of SibNIA's advanced airspace research department, at an aerospace conference.

The as-yet-unnamed aircraft, which is expected to pave the way for a bigger 30-40 seat variant, is expected to have a maximum take-off weight of 34,170lb

(15,500kg), a range of at least 1,865 miles (3,000km) and a cruising speed of 380kts. It will also have the capability to operate from short fields and in temperatures ranging from -60°C to +50°C (-76°F to 122°F).

easyJet Agrees Air Berlin Deal

Part of Air Berlin – excluding potential start-up and transitional operating costs – has been bought by easyJet for €40m.

The acquisition of assets at Berlin Tegel Airport is subject to regulatory approvals. The deal is expected to close in December and will result in easyJet entering into leases for up to 25 A320s, offering employment to Air Berlin flying crews and taking over other assets including its slots.

Air Berlin has filed for insolvency and a German Government loan is enabling operations to continue.

New Private Jet Centre at Southend

Stobart Aviation is set to open a new executive jet fixed based operator (FBO) – The Stobart Jet Centre – at London Southend Airport. It will replace the existing much smaller facility and was

due to open in November. The centre is expected to cater for 5,000 flights per year by 2022 and will be open 24 hours a day, seven days a week, 364 days a year, excluding Christmas Day.

WestJet's Scoop

WestJet has chosen the name Swoop for its new ultra low-cost carrier. The airline, which is scheduled to take to the skies next year, will be headquartered in Calgary, Alberta, and provide Canadians with what WestJet calls "a no-frills, lower-fare travel option", backed by "an airline with a proven track record".

Swoop flights will go on sale in early 2018 and plans to operate a fleet of Boeing 737-800 aircraft.

Southwest Heads to Hawaii



Promoting the film 'Coco', which is a computer-animated musical fantasy adventure. Southwest Airlines

Flights to Hawaii by US low-cost carrier Southwest Airlines will start in 2018. As part of that process, the airline intends to apply to the FAA for authorisation for Extended Operations (ETOPS), a regulatory requirement for services between the

mainland and Hawaiian islands.

The company is also promoting Disney/Pixar's latest film *Coco* via a special scheme on Boeing 737-7L9 N7816B (c/n 28009), which will wear the livery until the end of the year.

Chrono Marks Canada's 150th

Quebec City-based charter operator Chrono Aviation painted one of its Beechcraft 1900Ds, (c/n UE-150) C-FKNO, with special Canada 150 sesquicentennial markings for 2017. It also wears a special Bagotville International Air Show/Spectacle Aérien International de Bagotville (SAIB) markings, where it was static displayed in Québec in June.

The aircraft was previously painted in a special Star Wars style livery reminiscent of an Imperial Stormtrooper and proved popular with young science fiction fans at air shows. The company operates two Beechcraft 1900Ds, seven Pilatus PC-12s, a Bombardier Dash 8-100 and a Dassault Falcon 50EX.

Andrew H Cline



Chrono Aviation's Beechcraft 1900D C-FKNO celebrates Canada's 150th birthday. Andrew H Cline

Wizz Air UK Division

Hungarian carrier Wizz Air has announced plans to launch Wizz Air UK, a new London Luton-based division. The airline has applied to the CAA for an AOC and Operating Licence and expects to launch its first services – using British-registered aircraft – in March. The company said the UK subsidiary will employ up to 100 staff, including pilots, cabin crew and management, by the end of next year while it will also take control of many of the 41 routes already served by its Budapest-based parent. CEO József Váradi added: "[The UK AOC] is the natural, next-step in the development of our UK business and will bring additional investment and jobs to our UK base at Luton. The UK remains the single biggest travel market in Europe and we are currently the UK's eighth largest operator – this move is also part of our broader strategy to ensure that our UK operations are Brexit-ready."

Spanish Offshoot for Thomas Cook

Thomas Cook Group Airlines has unveiled plans for a new Spanish subsidiary. The Palma-based offshoot, Thomas Cook Airlines Balearics, has applied for its own AOC and expects to launch flights early next year.

Services will initially be flown by three Airbus A320s acquired from the group's Belgian division, replacing existing capacity provided by Frankfurt-based Condor. This in turn will enable the German carrier to axe several third-party aircraft leases.

Thomas Cook Group's Chief Airline Officer Christoph Debus commented:

"The new airline and base will provide us with the right platform to better manage the seasonal demand in our business, giving us more control at lower cost as we continue to expand the choice of destinations we offer our customers. With more than one million Thomas Cook customers flying into Palma every year, we have a strong existing infrastructure on which to build."

This follows news the group had reached an agreement with Montréal-based Air Transat that will see the two exchanging aircraft on a seasonal basis.

St Helena Airport Open for Business

The first commercial flight into St Helena Airport was operated by Airlink. Its Embraer 190 ZS-YAB (c/n 19000195) touched down on October 14 from Johannesburg/O R Tambo carrying 72 passengers.

It took six hours to reach the remote South Atlantic island via a fuel stop in Windhoek,

Namibia. Among the passengers were tour operators, the media and St Helenian expats.

Airlink will operate a weekly flight to St Helena every Saturday. Prior to the start of flights, visitors had to make a week-long boat trip, a service that is being discontinued in February.

Brussels Airlines' Farewell to RJs



Brussels Airlines' OO-DWE on delivery to Southend from Belgium. Simon Murdoch

Brussels Airlines has retired its last two operational Avro RJ100s, having at one time had a fleet of 32.

The era ended with the touchdown of OO-

DWD on a Geneva-Brussels flight on October 28. Airliner OO-DWE was ferried to London Southend Airport on October 13, returning to its leasing company, Falko Regional Aircraft.

Airlander Holiday Trial Nears

Airlander has announced travel experts Henry Cookson Adventures (HCA) will be the first to trial an expeditionary journey next year as a precursor to the airship's use for luxury travel and adventure holidays.

Hybrid Air Vehicles has also said Design Q is its preferred supplier for design and manufacture of the luxury cabin interiors.

The aircraft company said the work had been given to Design Q because of its "extensive experience in specialising in the early stage design and build of luxury aircraft interiors".

Air Senegal Gears Up



Two new ATR 72-600s for Air Senegal were spotted at Toulouse on October 17. The aircraft, F-WWEZ (c/n 1452) and F-WWET (c/n 1447), will be registered 6V-ASN and 6V-AMS respectively, once delivered to the start-up carrier. The airline plans to launch operations in December. Eurospot

New Owners for Leeds Bradford

Leeds Bradford Airport is to have new owners. AMP Capital, on behalf of investors in has agreed to acquire the business from Bridgepoint Advisers.

Simon Ellis, Head of Origination, Europe at AMP Capital, said: "We believe there

is a clear opportunity for performance enhancement through tailoring and improving the customer experience and working collaboratively with our key partners including airlines, government and local businesses.

"AMP Capital's heritage in transportation

infrastructure investment and our experience of owning airports means we are well placed to develop the exciting opportunities presented by this investment."

AMP Capital is a global business based in Australia.

Channel Islands' Newcomer

New on-demand air taxi provider Waves, based on Guernsey, operated its first service to the neighbouring island of Jersey on October 11 as part of what it describes as a 'friends and family' soft launch.

The carrier said the aim was to test each stage of its operation from booking and boarding, through to flying and disembarking. Passengers flying with Waves may book seats via a dedicated Uber-style app.

Waves' first passenger service, flown by its sole Cessna Grand Caravan 2-CREW (c/n 208B2148), came just weeks after the airline secured its Air Operator Certificate.

Boeing's Gatwick Hangar Approved

Boeing's proposed plan with Gatwick Airport to build a new aircraft hangar has been granted planning permission with full works scheduled to start later this year.

The facility will be fully operational in early 2019 and will add on-site engineering and maintenance capability for operators of Boeing aircraft at Gatwick, including short-haul 737s and Gatwick's growing long-haul fleet of 747, 777 and 787 Dreamliner aircraft.

The new facility will also support Boeing's Global Fleet Care customers.

Middle East Air Link Resumes

A scheduled passenger service – by budget carrier flynas – has been flown between Iraq and Saudi Arabia for the first time in 27 years.

Flights stopped in 1990 after Saddam Hussein's forces invaded Kuwait, triggering the first Gulf War, but resumed on October 18 this year when a flynas Airbus A320 touched down in Baghdad from Riyadh.

The carrier reports it will introduce 35 flights per week between the two countries including services from Dammam to Najaf (14 times weekly), plus Jeddah to airports at Baghdad, Erbil and Najaf (via Medina) each flying seven times a week.

Rock in Rio 737



An eye-catching livery on Boeing 737-8EH PR-GUO (c/n 35850), as GOL celebrated its position as the main sponsors of the 'Rock in Rio 2017' music festival. The aircraft visited Buenos Aires/Aeroparque Jorge Newbery on October 17. Rafael Reca

Elixir Progress



The French-built Elixir that made a maiden flight lasting 45 minutes. Brian G Nichols

The French-built Elixir aircraft was exhibited at the ULM Blois light aircraft show in Central France on September 1 following its first flight the previous day at La Rochelle. The Elixir, which had been seen in unfinished condition at the Paris Air Show in June, flew for 45 minutes on its first flight, flown by the company's test pilot Daniel Serres, and reached an altitude of 5,000ft (1,524m).

It is primarily targeted at the flying club

training market and is an all-composite two-seater powered by a Rotax 915iS engine with a T-tail, a fixed tricycle undercarriage and a forward-hinged cockpit canopy.

Elixir Aircraft has taken ten pre-orders for the aircraft with the first unit to go to the La Rochelle Aéroclub. The aircraft is priced at €150,000 (£132,300) and the company intends to build 12 in the first year of production, and 50 to 80 annually thereafter.

Rod Simpson

Hi Fly A330 Clean Seas Message



Hi Fly Airbus A330-200 CS-TQW now wears a special colour scheme to promote a 'clean seas' message. The Portuguese charter airliner was at Manchester Airport having been painted Air Livery in the new scheme, which promotes the Mirpuri Foundation marine conservation group's entry in the Volvo Ocean Race 2017-18, called 'Turn the Tide on Plastic'. The race started in Alicante, Spain on October 22 with a first leg to Lisbon. Ashley French

CIVIL ORDERS

Airline	Aircraft	Number	Order Placed	Notes
Aircalin	A320neo	2	October 11, 2017	Order firmed up
Aircalin	A330-900	2	October 11, 2017	Order firmed up
Singapore Airlines	777-9	20	October 23, 2017	
Singapore Airlines	787-10	19	October 23, 2017	This and 777-9 order (above) previously attributed to unidentified customer
China Southern Airlines	777-300ERs and 737MAX	Unknown	October 23, 2017	Details once all contingencies have been cleared

IN BRIEF

ST MAARTEN'S Princess Julianna Airport reopened to commercial traffic on October 10, with repairs still taking place. The Caribbean airport, famous because landing aircraft fly low over beachgoers, was badly damaged by Hurricanes Irma and Maria.

A new non-stop service between Gatwick Airport and Taipei's Taoyuan International Airport, due to start on December 1, marks CHINA AIRLINES' return to the UK following a five-year break. The service will operate four times weekly using the carrier's fleet of new Airbus A350-900s. China Airlines previously operated from London/Heathrow to Taipei from 2010 to 2012, before switching to Amsterdam with onward connections via codeshare partner KLM-Royal Dutch Airlines.

SMALL PLANET AIRLINES Co has gained a Cambodian Air Operator Certificate (AOC) and will now use the ICAO-assigned callsign LKH. The majority shareholder in the Cambodian-based company is Aviation Invest Cambodia with a 51% stake. The Small Planet Group owns 29% and 20% belongs to the company's chief executives.

EASYJET is expanding in France with a new base in Bordeaux. The hub – due to come online next spring – will be served by three Airbus A320s and is the British low-cost carrier's sixth in the country after Lyon-St Exupéry, Nice, Paris/Charles de Gaulle, Paris/Orly and Toulouse/Blagnac.

PRIMERA AIR plans to expand its forthcoming transatlantic network from the UK. The Copenhagen-based airline has already confirmed it will use its soon-to-be-delivered Airbus A321neos to launch direct links from Birmingham and London/Stansted to New York (Newark) and Boston, but will now add non-stop connections to Toronto.

A second scheduled cargo service has been started by CARGOLOGICAIR. The new weekly route, served by the British carrier's Boeing 747-8s, links London/Stansted with Frankfurt, Dubai and Hong Kong. It follows the London-Atlanta-Mexico City route introduced in August.

A major increase in the number of weekly flights at LONDON SOUTHEAST Airport is planned for next year. Flybe and easyJet have outlined plans for additional routes starting next summer. Flybe, through franchise partner Stobart Air, will operate 80% more flights than this year via an extra based aircraft (its fifth in total), a new connection to Antwerp and increased frequency on existing services and the return of seasonal links to Dubrovnik and Zadar. EasyJet, will add a fourth based aircraft from July.

ETHIOPIAN AIRLINES and AZUL BRAZILIAN AIRLINES launched a new codeshare agreement on October 1. Customers will now be able to purchase tickets directly from Ethiopian Airlines to fly to seven destinations in Brazil operated by Azul. In return, Azul will be marketed on Ethiopian's network in Africa and further east. The African carrier has also added Jinka to its domestic network from Addis Ababa, launching connections to the southwestern city on October 25.

Manston Lightning Repaint



Repainting of the Lightning in Kent is coming to an end. Nigel Hodgson via Adam Cowell

Projects to repaint English Electric Lightning F.6 XR770 and PZL TS-11 Iskra (formerly G-BXVZ) at the RAF Manston History Museum in Kent are close to completion.

Fresh markings will be applied to the Lightning and a new canopy has been acquired to replace the badly clouded one currently fitted.

The Polish Iskra now represents an aircraft of the Bialo-Czerwone Iskry (White-and-Red Sparks) display team. With thanks to **Adam Cowell**

'Battle of Britain Heinkel'

A Spanish-built version of the Heinkel He 111 has been raised into a new position at the Berlin-based Militärhistorisches Museum der Bundeswehr. The restored CASA 2.111B has been in storage since the museum relocated from Uetersen in 1993.

The 2.111B was refurbished for a special display in Rotterdam two years ago, marking the 75th anniversary of the Dutch city's bombardment by the Luftwaffe on May 14, 1940.

The aircraft, which served with the

Spanish Air Force and participated in the filming of 1969's *Battle of Britain*, was returned to storage in Berlin afterwards. The museum's new exhibition hall, featuring the CASA, is due to open to the public next March. **Roger Soupart**

Dutch Centenary Marked by Texan

North American AT-6A Texan PH-TXN has been repainted by Wings Over Holland to represent '313' of the Marine Luchtvaartdienst (Dutch Fleet Air Arm). The aircraft arrived in the Netherlands just over a year ago – it had previously been operated in Sweden as SE-CHP.

Wings Over Holland owner Luuk van Hooijdonk and his team worked hard to finish the aircraft in time for celebrations to mark the Marine Luchtvaartdienst's centenary. They were still applying final touches on September 16 just before the aircraft flew to Den Helder for the Helder Show Maritiem. **Ben Ullings**

Sea Fury Home

Hawker Sea Fury T.20 VX281 is back at its base at RNAS Yeovilton, Somerset, after being grounded for around three years following an engine failure. It was returned to the skies by Weald Aviation at North Weald, Essex, on September 1 and returned to Yeovilton a fortnight later.

NZ Sunderland Goes Under Cover

Newly painted Short Sunderland NZ4115 has been taken indoors by the Museum of Transport and Technology (MOTAT)

in Auckland, New Zealand. At the same time, Short Solent ZK-AMO Aranui was moved outside for further restoration work

and painting.

The long-term objective is to house the two together in the museum's Aviation Display Hall.

Comet Cockpit Section Restored

The front fuselage section of Comet C.2 XK699 *Sagittarius* has been restored by volunteers at the Boscombe Down Aviation Collection (BDAC) at Old Sarum in Wiltshire.

The complete airframe was previously a 'gate guard' at Lyneham, but when C-130 Hercules operations relocated to RAF Brize Norton in 2012, XK699 was put up for disposal. The aircraft had deteriorated to such an extent that only the cockpit section could be saved. **Hugh Trevor**

Landmark Day for Gatwick Shackleton



All four engines have been run on Avro Shackleton MR.3 WR982 at Gatwick Aviation Museum for the first time since 2008 at the August 5 open day. The 1958-built aircraft is currently undergoing a repaint, with the tailplane and fuselage already completed. Gavin Hoey via Dave Tyler

New Home for Canadian Lancaster

Several years of restoration will be carried out on Avro Lancaster Mk.10 KB882, which has been moved to the National Air Force Museum of Canada in Trenton, Ontario. The aircraft was transported in several sections by flatbed truck from Edmundston Airport, New Brunswick, where it had been a landmark for more than 50 years.

A target date of April 1, 2024, has been selected for its unveiling – to coincide with the 100th anniversary of the Royal Canadian Air Force. **Roger Soupart**



Lancaster KB882 is set to undergo an extensive restoration programme.

Hijacked Jet Goes to Museum

A Boeing 737-200, hijacked in 1977, is to be restored and go on permanent display at the Dornier Museum in Friedrichshafen, Germany. The Lufthansa aircraft (D-ABCE), named after the Bavarian town of Landshut, was taken over by terrorists on October 13, 1977 while en route from Palma, Majorca, to Frankfurt.

It was the start of a four-day ordeal for the passengers and crew as the aircraft was forced to travel to Rome, Cyprus, Bahrain, Dubai and Aden before reaching its final

destination in Mogadishu, Somalia. The hijacking was ultimately ended by a daring early morning raid by German special forces, which successfully freed all 86 hostages. Tragically, the aircraft's pilot, Jürgen Schumann, had been killed by the terrorists prior to the rescue. The Boeing 737-200 eventually went back into service and was later sold, ultimately flying for the Brazilian airline TAF Linhas, before being decommissioned in 2008. Since then, it had been abandoned at

Fortaleza Airport in northeastern Brazil until the German foreign ministry purchased the 737 in order to bring it 'home', describing it as a "living symbol of a free society, which cannot be defeated by fear and terror". A large crowd of officials, former crew members from the 1977 flight, international media and aviation enthusiasts saw Volga-Dnepr Airlines' An-124-100 and Il-76TD-90VD freighters touch down at Friedrichshafen with the fuselage, wings and components.

Wittering Harrier Gets 1(F) Sqn Markings



RAF Wittering gate guard, Harrier GR7A ZD469, had 1(F) Sqn markings applied on September 29. The unit flew from the base for many years. **Dino Carrara**

Warning Star Paint Job

Painting work has begun at Pima Air & Space Museum in Tucson, Arizona, on a Warning Star.

The Lockheed EC-121T 53-0554 is the military version of the Super Constellation

airliner and is currently coated in primer and eventually will be presented in the markings it wore with the 79th Airborne Early Warning and Control Squadron, based at Homestead, Florida, in 1974.

Curtiss P-40 at Pima

Pima Air & Space Museum in Tucson, Arizona, has bought a Curtiss P-40 from an Australian restoration shop. The museum decided to make the purchase because it would be quicker than restoring its stored, partial fighter for display.

The 'new' aircraft is made up of the parts from multiple 49th Fighter Group wrecks and substantial new-build parts. The museum is not aware of definite serial numbers for the source aircraft. Once reassembled and painted, it will be placed in Pima's newest display hangar, which is dedicated to aircraft operating in the Pacific during World War Two.

Aerospace Bristol Open

Aerospace Bristol, the home of the last Concorde to fly, opened on October 17 at the historic Filton Airfield. The family attraction aims to take visitors on a journey through more than a century of remarkable aviation history.

The exhibition brings Bristol's rich aerospace heritage to life; telling a story of ordinary people achieving extraordinary things, featuring exhibits including aeroplanes, helicopters, missiles and satellites.

The star attraction is Concorde G-BOAF, the last Concorde to be built and the last to fly.

Historic Storch Back in Norway's Skies

The first post-restoration flight for Fieseler Fi 156 Storch LN-WNS (Werk nr 1816) took place on October 7 from Kjeller, Norway, in the hands of Tor Nørstegård. The Storch completed a second flight on the same day following a few minor trim adjustments.

The aircraft has been restored over a ten-year period by a group of friends at

Fetsund, Norway. Following 9,250 hours' work, the aircraft now represents H3+BF, from Stab Jagdfliegerführer Norwegen, which was stationed at Forus, Norway, during the winter of 1943. The Storch will be based in the Oslo area, and is expected to fly at airshows next year. With thanks to **Tor Nørstegård**



AER LINGUS

REACHING NEW HEIGHTS

Aer Lingus is now settled under the wing of IAG.
Bernie Baldwin finds out about its plans and progress.

Aer Lingus has undergone many changes over 81 years of operations, but its latest round of innovation promises to be as important as any that went before. The airline wants to reinforce its European network while building long-haul services.

Exemplifying the new stance is Chief Strategy and Planning Officer Greg Kaldahl, who joined in July to take responsibility for network development, schedules, alliances and manpower planning. His appointment came as Aer Lingus approached the second anniversary of becoming part of International Consolidated Airlines Group (IAG), which is also the parent of British Airways, Iberia, Vueling and Level.

He has been assessing the benefits that being part of IAG has brought to Aer Lingus, financially and operationally, saying: "The most important element the takeover has offered is an opportunity to de-risk the business.

"Think of it this way: we have 11 widebody aircraft in the fleet, so to take on its 12th widebody – which delivers to us in November – is a fairly significant investment for Aer Lingus.

"Over and above that, the transaction offers an opportunity to look for synergies through the business. Most of those are going to be found on the cost side – opportunities for us to combine with IAG, their procurement elements, their IT elements – and to find ways to do things cheaper through process or through scale."

Kaldahl believes IAG has been exemplary in recognising Aer Lingus as a "pretty strong" business: "What they haven't done is come in and say 'Here's the way we do it. We need to do it this way'.

"No, they've been cognisant of the fact that the underlying business here is doing pretty well. So it's 'Keep on doing it, execute as you have been, but around the edges here are areas where we can help'.

As well as working with the holding company, Kaldahl and his team speak to other IAG carriers regularly. "There's a series of meetings that take place, opportunities to come and meet together," he noted.

"The network strategy group, the commercial group and the airport group:



Above: Aer Lingus's Boeing 757 operations to the east coast of North America are carried out by ASL Airlines Ireland. All photos Aer Lingus unless stated

Left: Aer Lingus Chief Strategy and Planning Officer Greg Kaldahl joined the airline in July 2017. He is responsible for network development, schedules, alliances and manpower planning.

each gets together on a scheduled basis. Participants from each of the carriers come together to work through common issues."

STRATEGY

Kaldahl gives a specific example where the airlines work together: "We go and approach airports – not as individuals, but as a collection of IAG carriers. "We'll look to negotiate positions with airports, particularly if they are in the middle of renegotiating terms and conditions with all airlines. We will do that together to try and drive the best outcome for IAG.

"That might include a win across all five IAG carriers or it might be more of a win for one rather than another. As long as we can derive benefits for IAG carriers then that's good."

For seven to eight years from 2006, Aer Lingus had to deal with takeover bids from Ryanair. It might be expected that the amount of politicking involved was a distraction, but Kaldahl – the self-confessed "new guy on the block" – has developed a different view.

"If you think about Aer Lingus and Ryanair, we've been competing for nearly 30 years now. This is nothing new," he observed. "Quite frankly, it's that competition that has shaped and moulded us into the carrier we are today, that has driven a transition of the business model and is driving efficiencies and costs and the products and services that we have today.

"Today we sit here with extraordinarily high customer satisfaction as measured by net promoter scores [NPS] and, if I'm honest, we have to attribute some of that to the fact that we had to compete against one of the best in the business over the last 30 years."

Giving an inside view from that time is Aer Lingus's Communications Director, Declan Kearney, who was with the airline through all three bids by Ryanair. He said: "I can honestly say that the focus was on performing and trying to grow the business – and that period when the three bids happened was the period of the deepest recession in the history of the Irish economy.

"We managed to grow during that period, despite the fact we were heavily exposed to the Irish market and Irish consumer sentiment. I don't believe the Ryanair bids held us back."

Kearney added: "We had a team who went off and dealt with the Ryanair bid – a combination of legal, financial and comms people – but the focus was on 'the business keeps moving'.

"If you look at most recent bid, what was happening within Aer Lingus was that we were growing our transatlantic operation, as we now had Terminal 2 at Dublin Airport. We suddenly had a whole new strategic potential where we could become a hub-and-spoke carrier via Dublin."

AIRBUS A321LR

On the operational front, Aer Lingus raised eyebrows when, on March 6 this year, it agreed a deal with Air Lease Corporation (ALC) to lease seven new Airbus A321LRs (the long-range version of the A321neo).

ALC announced on October 12 that a long-term lease agreement with Aer Lingus for one additional new A321neo LR aircraft had been agreed. The jet, to be delivered in June 2019, will be the eighth of this model leased to the airline and is from ALC's order book with Airbus.

Kaldahl is excited by the possibilities it brings: "This aeroplane is a whole set of opportunities which don't exist with a larger, widebody aeroplane," he enthused.

"What I mean is that if Aer Lingus had delivered this aeroplane as opposed to Airbus, we would have delivered its mission capabilities exactly the way Airbus did, so we could take advantage of Ireland's geographic position as the westernmost point in Europe by connecting Dublin to points in the northeast US and Canada.

"It's the ideal aeroplane for us, not only to provide schedule depth in markets that can also be served by bigger aeroplanes, but schedule breadth across markets that quite frankly just cannot support widebody capacity.

"It allows us to do so with a competitive advantage because [for airlines] further east in Europe, it covers less and less of the US. ►



"In terms of what to do with the aeroplane, everyone who sits in my chair at any airline does it the same way. We develop an opportunity list and then work down that list. The A321LR opens up so many opportunities in North America that I think we'll stay pretty busy taking advantage of [them]."

Kaldahl also acknowledged that at some point it will make sense to look for some long, thin opportunities eastwards or southeastwards, but such destinations sit much lower on the opportunity list.

Currently, as Kearney pointed out, the furthest east the airline flies is to Izmir in Turkey. "That's a short-haul operation with no overnighing. It's not a long-haul operation," he said.

"We flew to Dubai in the 2007-8 period, but it wasn't very successful. There wasn't enough of a market to fly point-to-point to Dubai with the A330. The A321LR could change the economics."

PARTNERS

Alongside its own fleet, Aer Lingus outsources certain flight operations – particularly regional services and transatlantic Boeing 757 flying to Stobart Air and ASL Airlines Ireland respectively. With the changes to its fleet over the next few years, it will have to think about levels of outsourcing, particularly the longer flights the A321LR could take over.

"We have a model that allows us to be quite flexible and very opportunistic," said Kaldahl. "So let's go through all the areas:

"We've got Stobart Air as a franchise partner. This [regional flying] is a world that is transitioning from being almost exclusively point-to-point to one that is much more of a network business, flowing passengers between Europe and North America.

"Stobart fills a critical role, connecting to smaller, thinner markets primarily in

The A321LR opens up so many opportunities in North America'

Ireland and the UK and feeding traffic to, and through, our hub.

"They take the commercial risk and we earn a bit of a franchise fee," he added. "We like Stobart as a partner – they do a great job for us.

"Likewise, ASL Airlines. This contract was done because it would not have made financial sense to have a standalone fleet of three or four aeroplanes requiring a different set of pilots, training requirements, spares and so on.

"Instead we negotiated a deal with ASL, who are providing our level of service and

serving markets we could not possibly serve with a 275 to 325-seat aeroplane. That business works pretty well."

Kaldahl cited a third outsource category, which Aer Lingus uses in two scenarios: "One is when we're covering some sort of operational disruption, such as an aeroplane out of service for longer than expected or grounded for a day. We lease in [the] capacity to maintain schedule and operational reliability.

"There's a stable of carriers out there in the marketplace – the Omni Airls, Hi Flies and so on – and it's important to know that anybody on our roster is a carrier we've gone and looked at and certified that it can operate to a set of Aer Lingus standards. In other words, there's work to do before you're ever on that candidate list for us.

"The other reason we use those carriers is because Ireland is still a seasonal business. There's more opportunity to make money in the summer than in the winter. So we might look to an Omni or a Hi Fly to operate services for us for a short period where we're not carrying the cost burden of that asset and its associated crews."

GUESTS' VOICE

As for the possibility that the 757s might be replaced by the A321LR, Kaldahl said the airline had yet to make that decision. "It will come down to what the opportunities are for those aircraft.



Airbus A330s provide the backbone of the long-haul fleet, with a 12th jet scheduled for delivery during this final quarter of 2017. The aircraft pictured is at Dublin Airport. AirTeamImages.com/RalfMayermann



This image: Aer Lingus regional flights, performed by Stobart Air's ATR 72-600s, operate in thinner markets, mainly Ireland and the UK, and feed traffic to and from the Dublin hub.



Right: Two 'Green Spirit' Airbus A320s promote Aer Lingus's role as the official carrier to the Irish rugby union team.

"If there's a rational and profitable opportunity to fly those, even alongside the A321LRs, we'll certainly look real hard at that. If, on the other hand, the A321LRs can replace all that flying, and there's nothing for those aeroplanes to do, then we'd probably let the contract expire."

Even though new aircraft are on their way, Aer Lingus has been developing the product on its current fleet. "When we think about what we offer on board, or our products and services on the ground, we start with the 'Voice of the Guest,'" Kaldahl explained.

"We've done a lot of work, going back about three years, in trying to listen to what's important to the guest and what the guest is prepared to pay for.

"What the guests have told us is to start with the things that are free – a friendly service, a smile, a personal touch. We hear over and over again that the character, the DNA, of Aer Lingus service includes 'friendly,' 'smile,' 'personal.'"

It probably helps that such characteristics are seen to come naturally, as they're often associated with Irish people. "As a non-Irish person, I absolutely agree with that. I swear that the friendliest people in the world live on this island," said Kaldahl enthusiastically.

"With what you might call the harder product, guests tell us they want a reasonable meal and a reasonable selection of in-flight entertainment (IFE). Also, and this is

particularly tied to stage length, Wi-Fi has developed into a requirement not an option.

"With the new aircraft types, those are the things you'll see us concentrating on. We were, I believe, the second European carrier to offer Wi-Fi on a transatlantic fleet and one of the few that offers it free in the premium cabin." Wi-Fi expansion is now planned across Aer Lingus's short-haul fleet.

'The new lounge is called '51st and Green', because technically the passenger has crossed the US border but is still on the Emerald Isle'

"This 'Voice of the Guest,' I cannot emphasise enough, is not something where you listen once, go off and do it then you're done," he stressed.

"We survey continually and while I cannot tell you what's going to be important for the guest three years from now, I can assure you that we will listen...and hear what that is."

Passenger service goes beyond the onboard product – covering areas such

as check-in and lounges – to provide an end-to-end feel for the Aer Lingus brand. Enhancements are being made to services offered on the ground.

Kaldahl related a recent example. "One of the things we heard from our transatlantic guests is: 'I like your service, your onboard product and your lounge, but I can only visit your [Dublin] lounge pre-security and [US] customs and immigration. So to clear [customs and immigration] I need to leave your lounge way too early to get through all those processes. Then I get to the other side and I've got nowhere [equivalent] to go.'

"It was precisely that feedback that led us to the arrangement where, once through security, there's a lounge within the pre-clearance facility."

The new lounge is called '51st and Green,' because technically the passenger has crossed the US border but is still on the Emerald Isle.

"We can't do everything guests would like to have, but we think we've got this right because we're now producing customer satisfaction scores plenty of other carriers would love to achieve," said Kaldahl.

LOW-COST CARRIER

While there is much talk about the new long-haul fleet additions, the short/medium haul network around Europe operates as a low-fare carrier with buy-on-board and



The new business class cabin on the Airbus A330.



The A330's new business class cabin features 16in high-definition touchscreen monitors from Panasonic Avionics.



The airline's workhorse is the Airbus A320, which can be seen regularly around Aer Lingus's European network.

unbundled offerings. To its credit, Aer Lingus still manages to pull some passengers away from the hard core low-fare carriers. Kaldahl outlines some differentiating factors. "Let's start with our ambition – to be a demand-led, value-based carrier and the No 1 value-based carrier across the Atlantic. We therefore focus on cost, service and simplicity," he declares "That's important to the question of differentiating factors because you cannot do that without a strong and sustainable European network that both provides the presence necessary to be that force in Ireland and also provides the flow necessary for that transatlantic business.

Kaldahl explained: "Let's start with our ambition: to be a demand-led, value-based carrier and the number one value-based carrier across the Atlantic. We therefore focus on cost, service and simplicity.

"That's important to the question of differentiating factors, because you can't do that without a strong and sustainable

European network that provides both the presence necessary to be that force in Ireland and also the flow necessary for that transatlantic business.

"Our European business [from Dublin] can take you to virtually all of the places you need to go in Europe. It does so on a four-star [Skytrax] carrier, landing you into the primary airports, not secondary ones. When we say we fly to Frankfurt, we really do fly to Frankfurt," Kaldahl quipped in a tongue-in-cheek dig at his local rival.

All carriers know the importance of collaboration and Aer Lingus is no different. Previously a oneworld alliance member, it now has codeshare/interline deals with Air Canada, KLM, Etihad Airways, Flybe, British Airways, United Airlines and JetBlue.

Kaldahl acknowledges the value of these agreements. "In some respects I view these relationships as I view our Stobart relationship. They create extensions to our network and opportunities to offer

destinations that Aer Lingus is not, in the foreseeable future, going to offer on its own.

"They enhance the total proposition to our guests, without us having to take the commercial risk of providing services to, say, the 40 to 50 places that JetBlue flies out of New York."

Kaldahl's admiration for JetBlue stems from his view that the US operator is similar by being a demand-led, value-based carrier: "No question about it. We're very much cut from the same DNA – obviously serving very different geographic locales, but we're very much alike."

The new kid on the block doesn't want to leave anyone unconvinced about how exciting he sees the future for Aer Lingus. "I've sat in more than a couple of different airlines now and I don't think I've ever sat in one where I've got as much enthusiasm and optimism about what the future looks like than I've found here," he proclaimed. "Perhaps unlimited is too strong a word, but there's a lot of opportunity out there." **AN**



A friendly service, a smile and a personal touch are part of the DNA of Aer Lingus, according to Greg Kaldahl.



The Airbus A330-200 has the longest range of any aircraft in the Aer Lingus fleet.



Airbus A321s feature on the thicker European routes. New A321neoLRs will facilitate single-aisle transatlantic flights. AirTeamImages.com/
Mehrad Watson



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VERSATILE CARIBOU

The Caribou is a rugged workhorse with short take-off and landing capability. **Stephen Skinner** looks at its career, which included providing vital supplies in the Vietnam War.



De Havilland Canada (DHC) worked closely with the American military to develop the Caribou into an aircraft that could be used in many roles where its ruggedness and ability to use short airstrips was advantageous. The aircraft can trace its

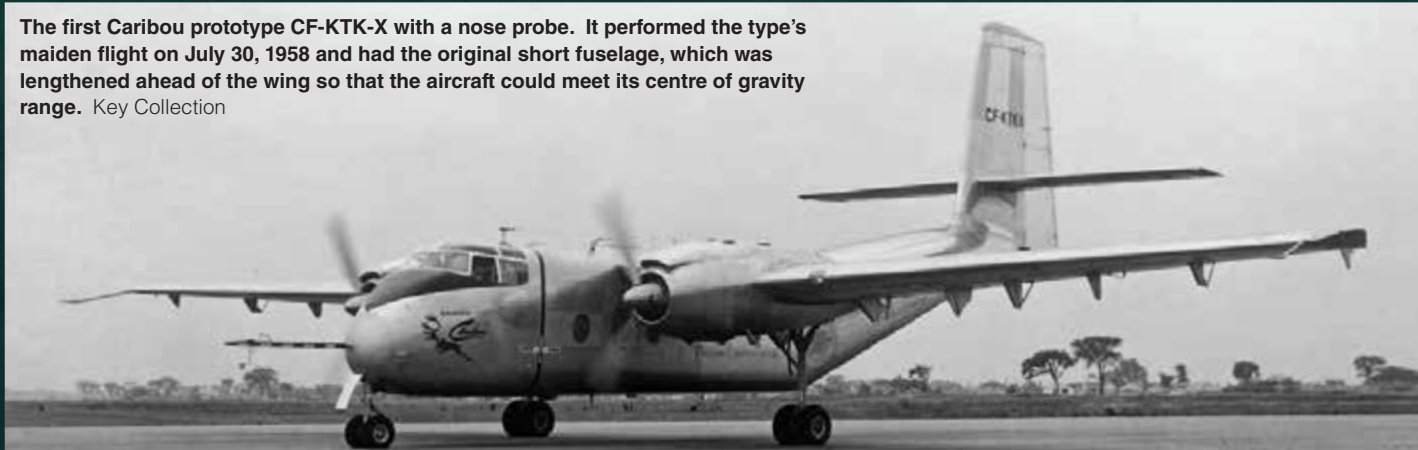
roots to the period after World War Two when manufacturers needed a more diverse range of products.

The company was established in 1928 as a wholly owned subsidiary of de Havilland Aircraft to assemble British-built members of the 'Moth' family

of aircraft at Downsview, Toronto.

The outbreak of war in 1939 brought large orders for Tiger Moths. Three years later, the first of 1,135 Mosquitos flew during a time of frenetic activity. Cancelled

The first Caribou prototype CF-KTK-X with a nose probe. It performed the type's maiden flight on July 30, 1958 and had the original short fuselage, which was lengthened ahead of the wing so that the aircraft could meet its centre of gravity range. Key Collection



A pair of AC-1As for the US Army at the de Havilland Canada plant at Downsview, Toronto. Note the unpainted Beaver under the tail of the example on the right. Key Collection



An RAAF Caribou with special markings to highlight the type's 45 years of service with the air arm. Sgt Rob Mitchell/© Commonwealth of Australia



orders and job losses came after the war was won as DHC took on refurbishment of Catalinas, Cansos, Lancasters, RCAF Vampires and other types, besides restarting Fox Moth construction.

NEW DESIGNS

Staff also started work at DHC on a low-wing, tandem-seat trainer, which became the DHC-1 Chipmunk and first flew on May 22, 1946. It sold well as a primary training aircraft and the Canadian plant built 217, but UK production at Hatfield and Chester far outstripped this at 1,014.

Even as the Chipmunk's design was being finalised, the company was working on the DHC-2 Beaver. This design was prompted by the Ontario Government's requirement for a 'bush' plane to provide services to remote and undeveloped areas. It was given the go-ahead in December 1946 and flew just six weeks later.

The great size of Canada made flying the

only viable means of transport and, within a few years, demand was so strong that the production rate reached one a week.

In 1950, the US Army took an interest and, despite severe competition from other types, the Beaver saw them off. Its short take-off and landing (STOL) capabilities and general

strength swayed the service.

The success showed there was demand for single-engined STOL aircraft. In 1950, factory engineers set about devising a scaled-up version with the same performance, double the payload and 150% greater cabin volume.

The prototype Otter took off at Downsview on December 12, 1951 using the same 600ft (183m) stretch of the runway the Beaver normally used. To achieve this stunning airfield performance, the Otter had double-slotted flaps and drooped ailerons. Ordered straight into production, purchases from both the US Army and Navy soon followed.

DHC-4 CARIBOU

Building on the success of its brand as a manufacturer of rugged STOL aircraft, the DHC designers considered a twin-engined Otter in 1954, but found it was not viable. The very successful DHC-6 Twin Otter of 1965 was a redevelopment of the Otter with twin turboprops and was aimed at the commuter passenger market.

The US Army, a major customer for the Beaver and Otter, revealed the need for a STOL aircraft capable of lifting three tons with a rear-loading capability. A detailed plan was put forward in early 1957 and the army, at a cost of \$500,000, ordered five of the new design, with delivery in two years. A production line was set down initially to produce 20 aircraft, including two prototypes and the five evaluation aircraft for the US Army whose interest was paramount – Canadian bush operators could not afford such an expensive type. ▶



Ansett-MAL operated VH-BFC IN New Guinea from August 1965 until January 1969. The Aviation Photo Company

US Army Caribou of the 457th Tactical Airlift Squadron, 483rd Tactical Airlift Wing at Katum Camp, South Vietnam, in May 1970. Key Collection



What was named the Caribou had a high wing and large tail and was powered by two Pratt & Whitney R-2000 piston engines of 1,450hp each. The STOL performance was achieved by incorporating double-slotted flaps over the entire span, lowerable to a maximum of 50°. Double-slotted drooped ailerons were also fitted in two sections each side, with the rear parts of the outermost portions of the flaps serving as ailerons. There were doors each side for passengers, while an air-openable door at truck-bed height, under the very high tail, allowed rapid loading of freight or vehicles using a short integral ramp.

Its structural design and construction compared best to the ubiquitous Dakota, in that it was rugged, simple and durable while it was maintainable using the same techniques as general aviation types.

As a multipurpose aircraft, it was able to carry 24 stretcher cases, 32 fully equipped paratroops or 32 passengers on tip-up seats along each side of the cabin that could be folded away to provide an uninterrupted cargo space of 1,150 cu ft (32.5m³).

FLIGHT TESTING

On July 30, 1958 the prototype DHC-4 Caribou CF-KTK-X took off on a successful two-hour maiden flight from Downsview. The second prototype CF-LAX-X joined the test programme in September.

During testing, it was decided to lengthen the forward fuselage by 42in (106.5cm) to

improve the centre of gravity range and this was incorporated into the third aircraft, CF-LKI-X, which was the first for US Army evaluation. This aircraft crashed only a few days after its maiden flight on February 24, 1959, when it suffered uncontrollable flutter and structural failure. No-one was injured, and the problem was easily solved.

'The US Ballistic Missile Early Warning System programme set the Caribou a tough task to deliver heavy loads into the Arctic airstrip of Resolution Island'

Stall clearance proved a problem for the aircraft. The US authorities insisted the Caribou complied with Federal Aviation Authority procedures. It was only after more than 1,000 stalls tests and aerodynamic modifications that the aircraft was finally cleared. These two issues delayed the programme and de Havilland Canada found itself financially extended. It had an order for

five from the US Army, but more Caribous were under construction, for whom there were no customers. The Royal Canadian Air Force (RCAF) stepped in and ordered four while the banks showed confidence in the company, tiding it over.

The US Army was satisfied the Caribou's problems had been solved but the Pentagon insisted there should be a competition to choose the aircraft for the army, even though there was not a competing type. The US Army's five evaluation aircraft YAC-1s, 57-3079 to '83 were delivered between October 1958 and the following March, but no mass order was forthcoming.

To press the Caribou's case, permission was requested from the FAA for a demonstration using a 900ft (274m) grass area of a parade square in Washington DC. The aircraft made a dynamic demonstration in front of military observers, landing and loading first 32 soldiers, then landing again to take on vehicles. This sealed an initial US Army order of seven AC-1 Caribous.

The manufacturer was not banking on all its sales emanating from the US Army and, between 1959 and 1964, the aircraft was sent on three extensive sales tours, deliberately operating from tiny runways normally the preserve of DHC's Beavers and Otters.

The ninth Caribou CF-LVA started from de Havilland's UK HQ at Hatfield on December 12, 1959 with a series of demonstrations to civil operators and both British and other NATO forces. It showed its STOL performance on grass, loaded with paratroops, a jeep and a trailer.

An extensive tour of Europe and the Middle and Far East followed, with a return to Downsview five months and 479 demonstration flights later. From October to December 1961, there was a tour of Latin America with CF-LAN and a final one from March to July 1964, when CF-OYE crossed the Pacific and toured Southeast Asia, then Africa, returning home across the Atlantic.

The US Ballistic Missile Early Warning System programme set the Caribou a tough task to deliver heavy loads into the Arctic airstrip of Resolution Island on Labrador in

C-7B 63-9757/IM of the US Air Force Reserve's 357th Tactical Airlift Squadron in 1973. The Aviation Photo Company





The Kenya Air Force took delivery of this aircraft, s/n 201, in 1965. It remained in service until 1986, when it was converted by Pen Turbo into DHC-4T Turbo Caribou N600NC with Pratt & Whitney Canada PT6A-67T turboprops and flew in the new configuration on October 3, 1996. It is still flying. Author's collection

February 1960, a task that would have been too much for the Otters normally serving the airstrip. The single gravel runway, which was without landing aids, was 1,300ft (396m) long and 100ft (30.5m) wide and, in winter, was formed of compacted snow and a very slippery surface. The runway sloped upwards with a sheer 800ft (244m) drop at the eastern end into the sea.

DHC provided the second prototype CF-LAN for the job and for 15 days it made six return trips per day from Frobisher, Baffin Island, uplifting 23,100lb (10,478kg).

OPERATORS

The US Army eventually purchased 159 Caribous; 56 were production AC-1As while the final 103 were AC-1Bs that could fly at higher weights and had weather radar. In 1963, to improve their landing performance even further, reversible-pitch propellers were introduced.

The Army Caribous were redesignated as CV-2As and CV-2Bs, respectively, in 1962 and, on transfer to the USAF in 1967, became C-7As and C-7Bs.

The army flew Otters in the Vietnam War and they were soon joined by their larger stablemates in 1962. Eventually, six Caribou squadrons served. Some 15% of all Caribou flight time was logged in actual warfare, notably with the US Army/USAF and the RAAF in South Vietnam, where the type became the standard fixed-wing transport. During the conflict, 20 were destroyed in combat or in accidents.

The Caribou was used for in-theatre personnel and equipment transport to forward landing strips. The final mission in Vietnam was in March 1972 and the final US military operation of the type came in 1983.

The RAAF was a major operator of the Caribou and bought 29 aircraft between 1964 and 1971. Their service record included eight years in Vietnam, where no Australian servicemen were killed on the aircraft, despite intense enemy action and several accidents. A total of 79,000 sorties were completed and, not surprisingly in that savage conflict, there were losses; three were destroyed and four damaged.

The aircraft proved itself as a dependable support to military personnel and the civil communities alike in northern Australia, Papua New Guinea, the Solomon Islands and East Timor. The type was finally retired in 2009 after 45 years' distinguished service.

The RCAF's initial order for four, which helped DHC when it was in an awkward financial position, consisted of the former first prototype CF-KTK-X registered as 5303, the ninth aircraft CF-LVA became 5320 and next two production aircraft became 5321 and 5322. Four more joined the fleet in 1964.

They were put to good use in the all-white livery on UN work; the first in Egypt and, in later years, there were missions to Cyprus, India, Pakistan, Peru and Yemen. The eight aircraft were sold to Tanzania in 1971, while the Canadians bought 15 Buffalos as replacements.

The Caribous' qualities guaranteed it a ready market with air forces. Newly independent Ghana received eight in 1963, which served until 1975 when half were sold to India. These four were added to the 20 purchased from DHC bringing the peak Indian Air Force Caribou fleet to 24. Gradually, from 1984, Antonov An-32s replaced these.

The Royal Malaysian Air Force had the distinction of taking delivery of the final Caribou from the Downsview production line in 1973, taking its fleet to 20. Spain was another large user and received 12 from

DHC in 1968-69, initially replacing Dakotas. Needing more after production had ended, the Spanish Air Force bought 18 from the US Army. One was lost in an accident. By 1991, the remaining aircraft had been completely replaced by CASA 212s.

The Tanzanian Air Force benefitted from Canadian aid, which included purchase of Otters and then eight Caribous. They were replaced in 1978 by HS748s and the DHC Buffalos.

From 1971, South Vietnam received 40 former US Caribous, but numbers in operation soon fell, owing to lack of spares, and none were in use after the country's defeat.

Other air arms that had small numbers were Abu Dhabi, Cameroon, Costa Rica, Kenya, Kuwait, Liberia, Oman, Sweden, Thailand and Uganda. Production of the Caribou ended in 1968, at number 307. Air America, which was a CIA-sponsored 'airline', operated various aircraft in clandestine operations. It bought two because of the impressive STOL performance, although there are reports of as many as four aircraft being used in supply – and even possibly as bombers – on the Ho Chi Minh trail, which ran from North Vietnam through Laos into South Vietnam during the war. There are further reports that Caribous were used against the Sandinista Government in Nicaragua in the 1980s.

DHC recognised that the civil Caribou market would be limited. Most examples



Kelowna Flightcraft's C-GVYZ in service on FIFO (Fly in-Fly out) mine support operations in Canada. It is seen at Whitehorse, Yukon, in July 1982. The Aviation Photo Company

were former military aircraft. They proved invaluable for FIFO (Fly in-Fly out) mine support operations in Canada where Propair and Kelowna Flightcraft were operators. Similarly, SEA Air and Greatland Air Cargo employed Caribous in Alaska.

Ansett-MAL of New Guinea bought VH-BFC which performed freight services there from 1965 until 1969, when the aircraft was sold. Guyana Airways had two late-production examples, 8R-GDO and 'GDP and InterOcean of Mozambique had three former US C-7s, C9-ATD, 'ATE and 'ATF.

As production of the Caribou continued, de Havilland Canada sought to capitalise on its investment and developed an improved version, the DHC-5 Buffalo which first flew on April 9, 1964. The US Army received four evaluation aircraft but did not acquire any other examples. The Buffalo predominantly was used by air arms with examples flying in Brazil, Cameroon, Canada, Mexico and Tanzania among others.

A total of 121 had been produced by the time the production line closed in 1988.

TURBOPROP

RCAF Caribou (5303), which was the former first prototype CF-KTK-X, was re-engined with General Electric T64s (2,344shp) in a US-Canadian joint programme and flew on September 22, 1961. Despite the benefits offered by increased thrust, the test bed had to be handled with care so it would not exceed design speeds. It was converted back to Pratt & Whitney R200s.

New Cal Aviation, which operated seven Caribous, instigated a programme to convert a former Kenyan example to Pratt & Whitney PT6A-67R power. Aircraft N400NC flew on November 16, 1991 but crashed during testing on August 27, 1992.



Prototype DHC-4T Turbo Caribou N400NC flew on November 16, 1991 but crashed during testing on August 27, 1992. Key Collection

On October 3, 1996 Pen Turbo of New Jersey flew DHC-4T Turbo Caribou N600NC with Pratt & Whitney Canada PT6A-67T turboprops. The Pen Turbo testbed was based on New Cal's proven, flight-tested and certificated turbo conversion which improved the aircraft's take-off performance, lowered maintenance and fuel costs and improved reliability.

Unlike many re-engine programmes, the Turbo Caribou maintained the power rating of the original R-2000 piston engines, with the PT6A-67T an exact fit to the existing nominal power ratings. Choosing an engine with an identical power rating and thrust significantly reduced risks and the design effort required in development and the flight test.

There would be no need to update the structural design, or expand the aerodynamic envelope. Pen Turbo stockpiled dozens of airframes for future conversion and N600NC was soon called into service with the US military, supply-dropping in Afghanistan in 2011-2012.

In addition to N600NC (now owned by the ODAC company), only two more conversions have flown: N238PT (owned by Aughrim

Holdings) made its maiden flight on May 19, 2010 and is currently flying in Africa; N303PT flew on September 17, 2014 and is still owned by Pen Turbo.

VIKING AIR

Bombardier bought DHC in 1992. In 2005, Viking Air acquired the Original Type Certificates for the entire range of out-of-production de Havilland Canada aircraft, including the DHC-4 Caribou.

It became the OEM (original equipment manufacturer) for these aircraft with ultimate responsibility to operators for all aspects of the aircraft, from parts support through to design engineering and technical information.

The Caribou was a sound investment for DHC which built 307 over ten years. With its excellent STOL performance it was an invaluable tool for the US and Australian forces during the Vietnam War, but was also used in peaceful ways by other air forces and civil operators throughout the world. The versatility of the Caribou made it a challenge to replace and the RAAF only reluctantly retired its fleet after 45 years of service. **AN**



DHC-4T Turbo Caribou, N238PT on approach to Girona, Spain, on August 14, 2017. AirTeamImages.com/Jarvi Sanchez Utzet

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Bf 109s IN BRITISH SKIES

Chris Goss details the different variants of the Messerschmitt Bf 109 that appeared over Britain and how they performed in combat.



The 1940 German blitzkrieg sped across the Low Countries and France, putting Britain in the sights of Messerschmitt Bf 109s. German troops and aircraft massed, ready to invade the UK, but the first task fell to Hermann Göring's Luftwaffe: to help defeat the Royal Navy and destroy the RAF.

The Bf 109 saw plenty of action during the aerial dogfights above Kent, Sussex and towards London, tangling with the RAF's Hurricanes and Spitfires.

Once the battle was over, it was an infrequent intruder, although sometimes in great numbers. The last incursion was on December 26, 1944 as German forces were being forced back towards their homeland by invading Allied armies.

Although properly called the Bf 109, many RAF pilots referred to the aircraft as the Me 109.

FIGHTERS

The first appearance of the German

Oberleutnant Paul Steindl flying a Bf 109 E-4/B of Stab II/JG 54 in late 1940 on a fighter-bomber training mission. His aircraft was carrying a dummy 250kg bomb. All photos Chris Goss Collection unless stated

fighter over the UK was on the afternoon of July 8, 1940. The Bf 109Es of 4 Staffel/Jagdgeschwader 51 (4./JG 51), led by their Staffelfkapitän Oberleutnant Josef Fözö, had been scrambled from their base at Desvres, near Boulogne, to intercept RAF aircraft over the Channel. This was not the first time they had encountered British fighters off England as Oberfeldwebel Johann Illner had shot down Plt Off Douglas Milne of 64 Sqn off Le Touquet on the evening of July 5, 1940.

This time Fözö probably shot down Sqn Ldr Desmond Cooke, of 65 Sqn, north of Dover at 1545hrs, but at the same time a pilot from his squadron (Staffel) was downed.

Sgt Tony Mould, flying a Spitfire of 74 Sqn, was in the thick of the action and relates what happened: "Four of us were on interception patrol over Dover when I

sighted four Me 109s flying line astern on my starboard beam. I gave the order 'line astern' and turned to starboard, climbing up under the tail of the rear Me 109.

"I gave him a short 30° deflection shot, and he immediately half-rolled and dived to ground level followed by Red 2. In trying to follow him, I [momentarily] blacked out and lost sight of him, but I saw another Me 109 also flying at low level so I dived on him from about 3,000ft.

"He immediately dived to ground level and used evasive tactics by flying along the valleys behind Dover and Folkestone, which only allowed me to fire short deflection bursts at him. After two of these bursts, smoke or vapour came from the radiator beneath his port wing and other bursts appeared to enter the fuselage.

"He eventually landed with his wheels up as I fired my last burst at him in a field near Elham [not far from the Kent coast]. The pilot was apparently uninjured and I circled round him till he was taken prisoner."

This Bf 109 was being flown by Leutnant Johann Boehm when it crash-landed at Elham, Kent on July 8, 1940.



A 21-year-old Austrian, Leutnant Johann Boehm, was slightly injured in the forehead when he crash-landed his Bf 109E-3, Werk Nummer (W.Nr – works number) 1162, coded White 4 at Bladbean Hill, Elham in Kent. A second E-3 flown by Feldwebel Willi Gasthaus from 4./JG 51 was also damaged in this combat.

Nearly four hours later, another E-3 flown by Lt Albert Striberny of 3./Lehrgeschwader 2 (3./LG 2) was shot down by a Spitfire of 54 Sqn, but the German machine was destroyed when the pilot baled out and it crashed at Sandwich in Kent. From here on, crashed Bf 109s, intact or otherwise, became a regular sight in southern Britain.

During the Battle of Britain, several variants of the Bf 109E (nicknamed Emil) were used by the Luftwaffe. The E-1 was armed with two machine guns above the engine and another two in the wings. This was gradually replaced by either the E-3 or E-4. The E-3's wing armament was two MG FF 20mm cannon but further improvements

were introduced for the E-4. The basic differences between the two were better armour plating for the pilot, a modified more angular cockpit with greater visibility and upgraded MG FF cannon.

As the conflict continued, the Germans also began fitting bombs to fighters (known as Jagdbomber or Jabo).

The advantage of this was that after dropping its bombs, the aircraft could act as a fighter and by the end of the Battle, one Staffel per Bf 109 Gruppe was designated a Jabostaffel. Such aircraft could carry a 250kg (552lb) bomb and were designated E-1/B, E-3/B or E-4/B.

The first unit to do this was Erprobungsgruppe 210 (test wing) which had 1 and 2 Staffel operating the twin-engined Bf 110, and 3 Staffel flying the Bf 109E. Only four Bf 109E Jabos were lost by this unit between July and October 1940.

Of these, just two were claimed in combat – those of Lt Horst Marx on August 15, 1940, and Oblt Herbert Hintze on October 29, ►



Leutnant Johann Boehm under escort after being captured.



A Bf 109 E-7 of I./JG 53 in Pas-de-Calais in October 1940.



Hauptmann Rolf Pingel's Bf 109 F-2 after it was recovered by the RAF following a crash-landing.

1940. Both were taken prisoner when their aircraft crashed at Frant in East Sussex and Pluckley, Kent, respectively.

RANGE PROBLEM

The main drawback with the Bf 109 was its limited operating range. Even when almost all fighter units had moved to the Pas-de-Calais at the end of August 1940, London and the Thames Estuary was at the limit of their territory, especially when factoring in time for combat (normally 15-20 minutes maximum – most flights were of an hour's duration).

Bf 109s held off south of London after they had escorted the bombers in to the targets, saving fuel and avoiding the capital's anti-aircraft guns (flak) and met them again on the return.

As the Battle of Britain drew to a close, the E-7 was starting to appear that was capable of carrying a centreline drop tank but there is no firm evidence that such tanks were carried in the fighting over the southern counties.

However, Messerschmitt now took the Emil design and fitted a DB 601E-1 (initially the DB 601N) engine in an entirely redesigned and symmetrical cowling. The supercharger air intake was modified and moved out further from the engine, while the spinner was enlarged and the airscrew reduced. Shallower underwing radiators were fitted and the braced tail of the Emil was replaced by a cantilever unit.

Other external changes were rounded wingtips, different ailerons and flaps, a modified rudder and the tail wheel became fully retractable.

Armament was a single 20mm MG FF/M and two 7.92mm MG 17 machine guns (in the same configuration as the E-4) on what was now designated the Bf 109 F-1 variant, while a single 15mm MG 151 (in the nose) and two MG 17s (on top of the cowling) made it the F-2 variant.

The precise date when the first Bf 109F (nicknamed

Friedrich) arrived in France is not known but the first to use it in action was Major Werner Mölders, commanding officer of JG 51. By the end of September 1940 he had shot down 42 aircraft and had been awarded the Ritterkreuz mit Eichenlaub (Knight's Cross with Oak Leaves) to go with the Ritterkreuz already awarded on May 29, 1940.

He was clearly the best man to evaluate the new fighter, and so F-1, W.Nr 5628, coded SG+GW arrived at Pihen-lès-Guînes, southwest of Calais, in early October 1940 (an F-2, W.Nr 6060, would follow at the end of January 1941).

NEW TACTIC

Maj Mölders first flew this aircraft operationally on October 7, 1940, but from October 10 to 17, he went back to flying his E-4/N and increased his score to 48. At 1403hrs (UK) on October 22, 1940 he lifted off from Pihen, and 45 minutes later recorded the first kills of the war for a Friedrich.

Jagdgeschwader 51 was escorting Bf 109 Jabos attacking London when a number of RAF squadrons intercepted them, including a dozen Hurricanes of 605 Sqn from Croydon. The RAF aircraft were flying in pairs at 22,000ft over Tunbridge Wells and spotted enemy aircraft identified as eight Bf 109s 2,000ft above them and flying southeast.

Before they could close, they were bounced by two unseen Bf 109s which had split from another formation of five aircraft. Coming out of the sun, Mölders and his

wingman attacked 'A' Flight which was at the rear of the squadron in what was described afterwards as "...a new and successful tactic on the part of the Hun."

Plt Off John Milne's Hurricane was hit as was Plt Off Derek Forde's; Milne was wounded in the back and during a force-landing at the foot of the North Downs near Dorking, Surrey also fractured his pelvis. Forde managed to get his damaged fighter back to Croydon.

Mölders claimed three Hurricanes northwest of Maidstone at 1440hrs, 1441hrs and 1442hrs (German time). There were no other claims by German fighter pilots that day. Reports from 74 Sqn said the Spitfires of Fg Off Peter St John and Plt Off Bob Spurdle were shot down at 1350hrs crashing at South Nutfield, in Surrey, and Hadlow Place, near Tonbridge, respectively. It is, therefore, possible that Mölders could have got one of them.

Bf 109E losses still continued over the UK until the end of 1940 but the last aircraft to crash on land was an E-4, W.Nr 3708, coded White 2 of 7/JG 26 at 1210hrs on December 12, 1940. Shot down by Fg Off Vernon Bright and Plt Off Ron Bary of 229 Sqn whilst on a fighter sweep over Kent, Unteroffizier Rudolf Lindemann baled out wounded, his aircraft crashing at Abbey Farm near Leeds Castle in Kent. Shortly after this, most Bf 109E units returned to Germany for rest, recuperation and to convert to the Friedrich.

The first Bf 109 to crash in the UK in 1941

was an E-7 Jabo, W.Nr 6410, coded T of II (Schlacht)/LG 2 which was shot down by anti-aircraft fire while attacking RAF Hawkinge, near Folkestone, on February 8, 1941 killing Lt Werner Schlather. A few weeks later, a number of German fighter units returned to the Channel Front flying the Friedrich, which soon proved vulnerable to RAF fighters.

This brand new Bf 109 E-7 is fitted with the auxiliary fuel tank that would have proved invaluable during the summer of 1940.



On May 8, 1941, three Friedrichs of Stab./JG 3 led by Maj Günther Lützow took off from St Pol-Brias, about 40 miles (64km) inland from Le Touquet, on a fighter sweep. They approached the outskirts of London and

then turned for home. Before crossing the coast, the aircraft hit a fog bank and, as they emerged, were bounced by what they thought were Spitfires but were in fact Hurricanes of RAF Polish 302 Sqn.

Lt Günther Pöpel managed to shout a warning and all three broke left. Pöpel was to the right of Maj Lützow and the Hurricanes continued to chase them. Spotting a Hurricane on the tail of Lützow's aircraft, Pöpel turned towards it just as it dived away; he followed and related what happened next: "...he started flying erratically – no chance for me to hit him. He then steadied and flew in a gentle turn port and while I looked for a good position, I saw tracer pass my port wing – a Spitfire [sic] was shooting at me. At once I pushed the stick forwards and dived but a few seconds later, my fighter exploded. I blacked out but came to, opened my parachute and landed in a field where farmers brought me to a nearby farmhouse..."

Sgt Marian Rytka of 302 Sqn reported the Bf 109 that he had attacked issued black smoke, the wings fell off and the aircraft dived away; Fg Off Zygmunt Kinel stated his victim turned to port, the aircraft disintegrated and the pilot baled out, while Plt Off Wacław Król reported his Bf 109 exploded. Just the one was lost, the F-2 W.Nr 5467 flown by Pöpel which crashed at Park Gate Farm, Tenterden, in Kent.

A second F-2 from Stab/JG 53 crashed the following day but the RAF would have to wait until July 10, 1941 to get an intact example. Chasing Short Stirlings of 7 Sqn back across the Channel, F-2 W.Nr 12764 of Stab I./JG 26 suffered engine problems



A Bf 109 F-4/B fighter bomber of 10.(Jabo)/JG 2 in early 1942.

26, now operated over mainland Europe. Incidents of Bf 109 fighters being lost over the UK dwindled, partly because many Bf 109 Gruppe converted to the new Focke-Wulf Fw 190 from the summer of 1941.

The use of

Bf 109s as Jabos continued, mainly against shipping but on a much lesser scale than during the Battle of Britain. Oblt Frank Liesendahl of JG 2 formed a dedicated Jabostaffel with the F-2 and later the F-4, the first operational mission apparently being flown on December 25, 1941. Liesendahl experienced such success that in March 1942 his Jabostaffel became 10.(Jabo)/JG 2 and JG 26 was ordered to form its own 10 Staffel commanded by Hptm Karl Plunser.

The first loss for 10./JG 2 was due to flak on March 31, 1942 when Uffz Gottfried Weiser was shot down raiding Brixham in South Devon flying F-2 W.Nr 8171 which came down in the sea. On April 25, 1942, 10./JG 26 suffered its first loss when Fw Hans-Jürgen Fröhlich was downed by flak off Folkestone in an F-4, W.Nr 8353.

Only two Bf 109 Jabos would come down on land – on May 20, 1942, Uffz Oswald Fischer of 10./JG 26 was hit by flak striking a ship and he crash-landed his F-4, W.Nr 7232, coded White 11 intact at Beachy Head, near Eastbourne. Seven days later Lt Josef Fröschl of 10./JG 2 was shot down by Flt Lt Derek Wainwright of 41 Sqn while attacking shipping in the Solent. His F-4, W.Nr 7626, coded Blue 4 crashed near Brading on the eastern side of the Isle of Wight after he had baled out.

In June 1942, both Jabostaffel began converting to the Fw 190 which had already proven itself superior in all flight parameters (apart from turning radius) to the Spitfire Mk Vb. It could also carry a single 500kg (1,102lb) bomb under the fuselage and four 50kg (110lb) bombs under the wings, twice ►

'He immediately dived to ground level and used evasive tactics by flying along the valleys behind Dover and Folkestone which only allowed me to fire short deflection bursts at him'

Skalski of the Air Fighting Development Unit was overcome by fumes and crashed at Fowlmere, not far from Duxford, in Cambridgeshire, killing him.

FIGHTER-BOMBERS

Most German fighter units moved eastwards after the Soviet Union was invaded on June 22, 1941. Those left in the west, JG 2 and JG



This Bf 109 F-4/B of 10.(Jabo)/JG 26 was captured on May 20, 1942 and later had RAF camouflage and markings applied.

the bomb load of a Bf 109F.

The last combat loss for 10./JG 2 of an F-4 came on May 31, 1942, making a total of six aircraft on operations, while 10./JG 26 lost four F-4s, the last being on June 9, 1942.

RECONNAISSANCE

It is believed the Luftwaffe began to consider using the Bf 109 for reconnaissance missions in the spring of 1941 following the capture of a number of photo reconnaissance Spitfires. Uffzr Kurt Thüne, who would be the first and only Bf 109 reconnaissance pilot to be captured over Britain, joined 1 Staffel (Fern)/Aufklärungsgruppe 123 (1.[F.]/123) at Buc, near Paris, at the start of July 1941 and flew just four missions before he was injured in an accident on September 1, 1941.

By the time he returned to flying in December 1941, his unit had five Bf 109 E-7s modified with a camera in the fuselage and, when necessary, an additional two smaller cameras in the wings instead of guns. More aircraft subsequently arrived and were possibly F-1 or F-4 variants.

Thüne was on a sortie on January 7, 1942, which covered Devonport, Plymouth and Exeter. The cockpit of his E-7, W.Nr 4970, coded 4U+SH, filled with fumes and his engine failed. Unable to restart the engine, he baled out and his aircraft crashed at Buckfastleigh on the eastern edge of Dartmoor.

No more reconnaissance Bf 109s crashed on land and by the end of 1942, nine F-4s had been lost in combat from both 1.(F)/123 and 4.(F)/123, seven of them to RAF fighters.

In 1943, 5.(F)/123 was formed with the Bf 109G-4 (Gs being nicknamed Gustav). The type was fitted with a new engine, improved guns and a better radio. Another 13 of this variant were lost on operations during the year. Most sorties ranged from East Anglia to Cornwall but in June 1943, 1.(F)/120 received three G-4s and operated from Stavanger in



Unteroffizier Willi Drude of 7./JG 77 who defected while flying between Aalborg, Denmark and Stavanger, Norway, landing at RAF Dyce in Scotland on December 26, 1944.
Willi Drude via Chris Goss

Norway over the Royal Navy's Scottish base at Scapa Flow. The aircraft had been fitted with long-range wing tanks.

Just three aircraft of this variant were lost in UK operations – on November 17, 1943, Hptm Willi Lerche failed to return; his aircraft probably suffered an engine fire, and then on February 20, 1944, Plt Off Ian Blair DFM of 602 Sqn shot down an "Me 109 F carrying long-range tanks 40 miles east of Duncansby Head [northeast Scotland]". This was G-6, W.Nr 20357, coded A6+XH flown by Oblt Helmut Quednau.

Missions over both north and south of Britain became increasingly difficult in 1944 due to Allied defences, and the last recorded

loss of a Bf 109 on a reconnaissance flight over the UK occurred on May 12, 1944 when Oberfähnrich Gerhard Kohlweg of 1./Nahaufklärungsgruppe 13 failed to return from a sortie to Exmouth, near Exeter, in G-5, W.Nr 110076, coded White 11.

From D-Day, June 6, 1944, onwards, reconnaissance Bf 109s were used solely over France or well away from the British coast.

LATE ARRIVALS

Operational Bf 109s were not seen that often over the UK in 1944 but two landed in error and two defected.

On the night of July 21/22 1944, Fw Manfred Gromill of 3./JG 301 made a wheels-up landing at RAF Manston, Kent, in G-6, W.Nr 163240, coded Yellow 8, whilst Lt Horst Prenzel of 1./JG 301 in G-6, W.Nr 412951, coded White 16 landed normally at the same airfield.

On May 15, 1944, Oberfeldwebel Karl Wimberger of 1./Jagdfliegerschule 102 defected. He was flying circuits at Zerbst near Dessau, north of Leipzig, but flew away to carry out a wheels-up landing at Herringfleet, near Lowestoft, in his dual seat G-4, W.Nr 15110, coded White 22/DG+NR. Finally, on December 26, 1944, Uffz Willi Drude of 7./JG 77 defected on a flight between Aalborg, Denmark, and Stavanger, Norway. He flew low-level to the Scottish coast and landed at RAF Dyce, now Aberdeen International Airport, at 1531hrs but his G-14, W.Nr 463224, overturned, trapping the pilot. He was released without any injuries.

This Boxing Day incident was the end of Bf 109 activities in British skies. The aircraft continued in service until the end of the war in May 1945, having first entered service in 1937. Constant improvements helped it match Allied fighters right until the end. **AN**

Bf 109 G-6/U2 of 1./JG 301 wearing the RAF serial TP814. The aircraft landed in error at RAF Manston on July 21, 1940. It crashed on take-off from RAF Wittering on November 23, 1944.



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Book

Written by: Rick Morgan

Price: £13.99

Between 1974 and 1996, the Grumman A-6 Intruder was an important element of America's ground attack capability aboard its aircraft carriers. While the type had performed well in Vietnam, as described in a previous Osprey volume by the same author, the lessons of combat showed it was in need of some improvement. As a result, Grumman produced the A-6E with up-to-date multi-mode radar and – most importantly – more powerful engines with increased reliability.

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And finally, we are told how the A-6 was phased out in favour of the F/A-18 Hornet and strike-modified F-14 Tomcat. The author, a former naval aviator himself, says that

Intruder supporters will argue that neither possessed the all-weather or range benefits provided by the A-6, let alone the value the aircraft could offer as a tanker. He claims that almost 20 years later mention of the Intruder still elicits comments such as "retired too soon" and "wish it was still in the fleet".

Published by Osprey Publishing: ISBN 9781472818775 and is available from www.ospreypublishing.com

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THE BIRTH OF STEALTH

LOCKHEED AND THE CIA

Paul Crickmore explains early US efforts to hide aircraft from radar following the shooting down of Gary Powers' U-2.



The Cold War stand-off between the Soviet Union and America was made worse in the 1950s because neither side truly knew the strength and capabilities of the other. It fostered

mistrust, which US President Dwight D 'Ike' Eisenhower tried to heal during the Geneva Summit of July 21, 1955.

The meeting, between the USSR, USA, Britain and France, aimed to reduce growing

Above: **Project Tagboard** was a short-lived programme utilising a small, extremely stealthy, ram-jet powered drone that was designated D-21 (D standing variously for Drone/Daughter), and was launched from the back of a converted A-12, which was re-designated M-21 (M for Mother). Two A-12s were converted to carry the drones, and a launch control engineer was located behind the pilot. Note the RAM which is painted black on both the drone and M-21 – later in the programme both vehicles were paint overall black. Lockheed Martin



Left: **Aeronautical engineering genius and Skunk Works boss, Clarence L 'Kelly' Johnson**, with two of his designs, the U-2 and the basis of its blueprint, the F-104 Starfighter. U-2s, A-12s/SR-71s were referred to 'in-house' as Articles. Here the CIA U-2C is sporting a 'civilian' registration, which was applied when flights over Cuba began in late 1960. Lockheed Martin

Cold War tensions. Eisenhower proposed an 'Open Skies' policy between the two opposing ideologies, allowing a limited number of annual reconnaissance overflights to verify claims of declared force strengths.

However, Soviet Party Secretary, Nikita Khrushchev's paranoia ensured the proposal failed.

Nine months later, with six Central Intelligence Agency (CIA) pilots, and ten ultra-high-flying Lockheed U-2s ready for operational deployment, Project Aquatone, the President's contingency to 'Open Skies' was ready.

U-2s DEPLOYED

A major factor influencing Eisenhower's decision to authorise Operation Overflight was a US National Intelligence Estimate (NIE), noting the Soviet's standard V-beam early warning radar, the P-20, NATO reporting name *Token*, "had no capability above 60,000 feet." Having read the detailed brief on Aquatone, Eisenhower wanted all vital targets covered as quickly as possible. He also made clear that he would halt incursions if they were tracked by Soviet radar.

In April 1956, and in anticipation of the President's decision, two U-2s were deployed to Europe. They were initially based at RAF Lakenheath, Suffolk, under the entirely fictitious unit designation of 1st Weather Reconnaissance Squadron, Provisional (WRSP-1). They were moved to West Germany and the first U-2 overflight of the Soviet Union was completed on July 4, 1956, from Wiesbaden AB, by CIA pilot Hervey Stockman. What was termed mission 2013 covered targets around Minsk and Leningrad,



U-2s pictured at Site 2, Palmdale, in about 1972. The aircraft's adaptability and low operating costs have ensured that it continues to make a vital contribution to intelligence gathering. The two bare-metal aircraft have the last two digits of their Article number painted on the intake: Articles 347 and 367. To enhance security, the Skunk Works referred to airframes as Articles, and allocated each a sequential number that had no correlation with allocated USAF serial numbers. Lockheed Martin

but peering through the aircraft's drift sight, Stockman saw MiG fighters climbing in an attempt to intercept. Contrary to all American hopes, the flight had been detected.

Four other missions followed in rapid succession, but on July 10 the USSR made a diplomatic protest. Eisenhower immediately suspended the operation.

He was extremely annoyed that assurances given by his advisers had proved false. When the missions eventually resumed, Eisenhower retained tighter control. His message to the CIA's U-2 programme manager Richard (Dick) Bissell, was clear: make the U-2 invisible to radar.

On August 16, 1956, Bissell, convened a meeting to explore initiatives that could be developed into U-2 radar camouflaging techniques, addressing the President's concerns.

Clarence L 'Kelly' Johnson, President of Lockheed's Skunk Works, later wrote: "... Worked till 1:30 and two bottles of Scotch. Up at 7:00 and we resumed – even Dick [Bissell]. By noon we had program 'X' going. My biggest job now."

By midday, they had devised a programme that would explore various radar-cancelling

devices and the project was accorded the classified cryptonym Rainbow.

Dr Edwin Land chaired the project and, via Marshall Holloway, Director of the Massachusetts Institute of Technology (MIT), Lincoln Laboratory, based in Lexington, Massachusetts, a small number of radar experts were recruited.

Based in a secure building on the roof of the Lincoln lab (radiation laboratory and often referred to as the Rad Lab), the team included Dr Frank Rodgers (associate head of the Lincoln lab's radar division), and Norm Taylor. Two years earlier the highly influential Land Panel had recommended to Eisenhower that the U-2 be built in preference to other design submissions and that, controversially, the CIA, not the USAF, should conduct the missions over the USSR.

As a result, the development and operational deployment of stealth was driven by the political will of President Eisenhower and would be achieved by Lockheed working in partnership with a civilian intelligence agency.

LIMITED SOLUTIONS

The problem facing the team was that a U-2 overflight encountered both low frequency early warning surveillance radars, operating ►



Above left: A U-2 having radar-absorbent material (RAM) – Echosorb – applied to its lower fuselage. Lockheed Martin



Above right: In an attempt to hide the U-2 from Soviet radars operating in the metric (VHF) wavebands, wires were positioned at carefully measured distances from the aircraft's wings, fuselage and tail surfaces. Lockheed Martin

within the V-beam (65-86 MHz), and also high frequency S-band (2-4 GHz) and X-band (8-12 GHz), target acquisition radars. Since a single broad-band solution (one that would counter all the various frequencies), wasn't technically feasible at the time, different methods and materials would need to be developed to defeat the different radar systems illuminating the target.

Two limited solutions were eventually fielded.

One for S-band radars consisted of a radar absorbent material (RAM) treatment called Echosorb, nicknamed 'wallpaper', which was applied to the underside of the aircraft's fuselage. Just 1/4in (6.35mm) thick, it comprised Fibreglass, a honeycomb spacer, a graphite-impregnated layer, a protective sheet for durability and finally a coat of paint. The graphite-impregnated layer contained electronic properties causing it to behave as though it were much thicker. This meant that even though the coating was 1/16 of a wavelength in thickness, it acted as though it was 1/4 of a wavelength.

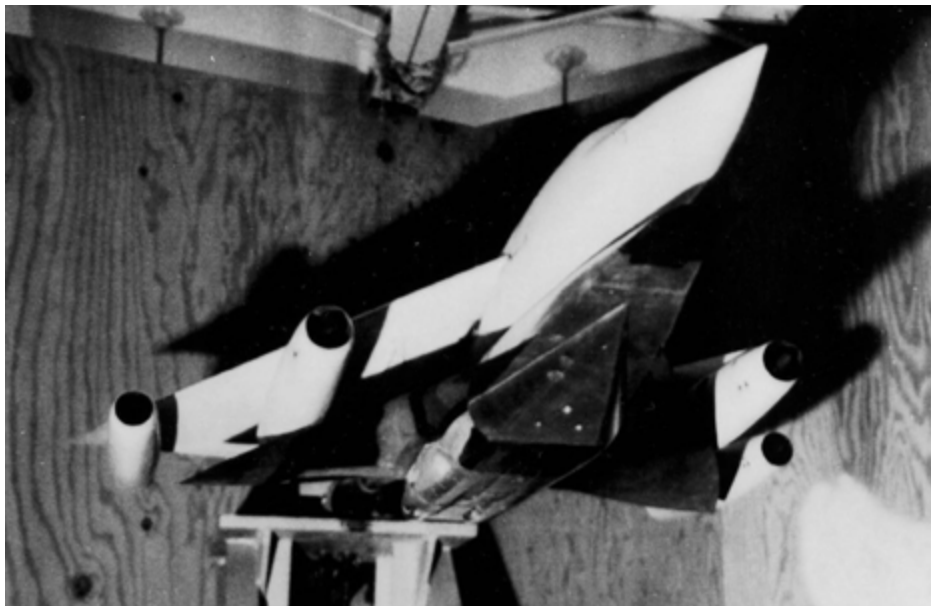
By positioning the graphite layer effectively 1/4 of a wavelength from the aircraft's skin, it would reflect some of the incoming radar energy.

The remaining energy would strike the U-2's actual surface and be reflected, but these 'emergent waves' would cancel out the reflective waves, as they were 180° out of phase with each other. It was also found that by cutting a small iris into the centre of each square of 'wallpaper', it would also resonate and reduce returns from X-band (8-12 GHz) radars.

The greatest difficulty, however, was

how to deal with the Soviet early warning surveillance V-beam radars with their 14ft (4.26m) wavelength. The Rad Lab and a small team of Skunk Works electronic engineers eventually developed two systems referred to as 'Trapeze' and 'Wires'.

Trapeze featured copper-plated steel wires strung span-wise around the leading and trailing edges of both the wings and horizontal tail. To adjust the impedance of the wires, ferrite beads were strung on them at precise locations.



Convair's redesigned Super Hustler was the basis for their entry into Project Gusto. Renamed First Invisible Super Hustler (FISH), the radical design combined extreme speed and altitude with a very small RCS, however it was dependent upon a B-58B for launch. Wind-tunnel models of the combination are seen here. Convair

Chord-wise wires connected the span wire to the wing edges, and ferrite beads were again used for tuning the frequency response. 'Trapeze' thus formed a slow wave structure, which induced currents that suppressed the rhombic lobes that were otherwise generated by a U-2's wing and tail planform.

To counter the U-2's fuselage reflections, which occurred at some frequencies from the sides, the team developed 'Wires'. A sort of Salisbury screen (a way of reducing the reflection of radio waves from a surface) was created by placing groups of ferrite beads at regular distances on long wires running along the fuselage and vertical tail surfaces. Each long wire behaved as though it were a series of separate wires – or dipoles, which counteracted the radar signal.

Two U-2s dedicated to Rainbow were based at Watertown, Nevada, (a purpose-built base

for the clandestine operation, later known variously as The Ranch and Area 51). Modified flight-test results revealed that 'Trapeze' reduced 70 MHz returns by 20 decibels (dB) and S-band returns by about 10 dB, so overall, the aircraft's radar cross section (RCS), was reduced to half its earlier detection range. But the "draggy" modifications reduced the U-2's range by 20% and its altitude by 5,000ft (1,524m).

On May 6, 1957, Bissell and Director of Central Intelligence (DCI), Allen Dulles, briefed Eisenhower on the expected results of Rainbow. Bissell was extremely upbeat and believed that the majority of treated U-2s undertaking Soviet overflights now stood a good chance of avoiding detection entirely.

In an operational evaluation, two U-2 penetration flights of the Soviet Union were made from Turkey on July 21 and 30, 1957. Analysis of the aircraft's System 5 (a multi-band radar recorder), revealed Soviet radars had detected the U-2's presence when flying directly towards and directly away from the radar head. Further tests showed the source of these returns had emanated from the aircraft's inlets, cockpit and exhaust – none of which could be treated by what had thus far been developed. Clearly a far more radical approach was required.

WAY FORWARD

In January 1958, the CIA assigned the classified cryptonym Gusto to phase two of Rainbow and cancelled phase one. Bissell knew this next stage of the project would be both high-tech and high risk. To assist him in evaluating proposals, he once again called

upon Land to serve as chairman of an advisory panel.

Frank Rodgers at the Lincoln lab went back to basic research to understand the relationship between a radar return and its physical shape, without regard to the aerodynamic practicalities of such shapes. To his surprise, he discovered that by layering six varying

diameter circular sheets of Teledeltos paper (a paper with a constant resistance), over a saucer shape, reduced resistance to 300 Ohms – the same as free-space through which the



Kingfish was Convair's heavily revised proposal following the company's failure to gain orders for the B-58B from SAC. The RCS test model is seen upside-down on its trailer. Convair

The bare metal finish of A-12 Article 121 shows to good effect the triangular panelling applied to the fuselage and wing leading edge and trailing edge planform that would, on later aircraft, be filled with RAM. Lockheed Martin



radar wave was moving, rendering the shape invisible. Rodgers had produced a 'broad-band' treatment that was effective against radars operating over a very broad range of frequencies. Unfortunately, the vehicle's shape was aerodynamically unstable, but Bissell was impressed and instructed Rodgers and Taylor to present their findings to Johnson.

Rodgers began to explain that the ideal shape for a stealthy aircraft was a flying saucer. To which Johnson replied: "For Christ's sake!", adding that he couldn't make a real aircraft that shape, and that clearly Rodgers knew nothing about aerodynamics. An equally belligerent Rodgers retorted that Johnson obviously knew nothing about radar. That was the end of the meeting.

Rodgers and Taylor wisely decided that in future they would leave final design decisions of a U-2 replacement to Johnson, and instead feed him RCS guidelines that could be incorporated into his design.

Initially, Johnson and his small team of Skunk Works design engineers worked on a number of subsonic, low RCS designs, known within the Agency as Gusto Model 2.

Numerous permutations were studied under this overarching codename; one rejected design featured cutting notches out of the leading and trailing edge of the wing and substituting triangular wedges of graded dielectric material. This technique, called 'softening', avoided generating an abrupt change in resistance of an incoming radar beam when it first met the aircraft (it's these swift changes that generate reflections). Using this technique, the incident beam strikes the baseline of the triangle (the wing's leading edge), and it's then reflected from one internal surface of the wedge to the other, generating electrical currents that turn the radio waves' electromagnetic energy into heat.

The resistance progressively reduces to zero by the time the energy reaches the tip of the triangular wedge, at which point it matches that of the adjacent metal structure. Invented by Ed Lovick, of the Skunk Works, the technique would play an important role in reducing the RCS of Johnson's ultimate design.

The dichotomy was the seemingly inverse relationship between 'stealth' and platform performance. He was also concerned at the speed of Soviet radar development which, coupled with the inevitable use of more diverse radar frequencies would, he was convinced, further complicate the search for a panacea to these conflicting paradigms.

On April 21, 1958, Johnson began sketching his first Mach 3 design, which put

'This would turn out to be the most determined attack ever on any of the Blackbird family of aircraft'

extreme speed and altitude performance at the heart of vehicle 'survivability', rather than stealth. He named the design in his notebook 'U-3'.

"I drew up the first Archangel proposal for a Mach 3.0 cruise airplane having a 4,000nm range at 90,000 to 95,000ft." The notebook subsequently became known as his 'Archangel' notebook (insiders often referred to the high-flying U-2 as 'Kelly's Angel', but



This rare shot is a frame grab from a 16mm film taken at Kadena AB, Okinawa, of a Black Shied A-12 getting airborne. The completely bogus serial number of 77358 was applied in red on the tail. Its coat of black paint helped to reduce thermodynamic heating, also small iron particles, typically 3/10 microns (millionths of a metre), in diameter reduced radar returns when exposed to high-frequency target acquisition radars by partially absorbing and partially scattering incident beams. CIA via Toni Hiley

'Archangel' seemed more appropriate given the quantum leap of this new design).

Over a number of days, he refined the high-speed design, before reporting his findings to Bissell.

Frank Rodgers' Rad Lab team then conducted a blip-scan analysis of Johnson's U-3 proposal. By taking into account the design's speed, altitude and RCS, they were able to evaluate the dwell time, in which the aircraft remained within a radar beam and therefore its probability of detection. Three different frequency bands, 70, 600 and 3,000 megacycles per second were considered and the highly significant report become known as the 'Blip-Scan Study' – also the 'Rodgers Effect'. It identified specific design targets that became enshrined in the programme, namely a speed of Mach 3, an altitude of 90,000ft, and an RCS of not more than 12sq yd (10m²) and preferably less than five.

COMPETITION

In the spring of 1958, Bissell flew to Fort Worth, Texas, and met Robert Widmer, head of advanced development, at the Convair Division of General Dynamics. Bissell told Widmer he required a reconnaissance aircraft capable of flying undetected at 90,000ft with a 4,000-mile (6,437km) range and 2,000lb (907kg) payload. Bissell stated in his memoirs that he brought Convair into the project on a point of due diligence when it came time to award a multi-million-dollar contract.

However, others have stated it was done to keep Johnson in check as he was more concerned about performance than minimising RCS (minimum RCS values were something Eisenhower had insisted upon).

Convair's proposal was based upon a radical variation of a design called Super Hustler. This two-stage, parasite nuclear bomber required a modified B-58 to carry it aloft and accelerate it to ramjet speed prior to launch. The parasite would then continue to accelerate before the aft section was jettisoned to increase range. It was an interesting concept, but the proposed reconnaissance variant required a number of significant



Above left: **A monocoque wing fillet of RAM undergoing construction.** Lockheed Martin

Above right: **A frame grab of an A-12 being constructed which shows the serrated titanium wing leading edges before the high-temperature-resistant triangular shaped RAM was installed.** Lockheed Martin

changes – not least because jettisoning sections of aircraft was hardly covert.

In addition, Super Hustler was not stealthy, therefore a team under Donald R Kirk, began working on a design referred to as First Invisible Super Hustler or FISH.

Consisting of the front section of the Super Hustler, FISH would be powered by two ramjets and launched from a modified B-58B. It would then accelerate to Mach 4.2, cruise at 90,000ft and have a range of 3,900, (6,276km). Completing its mission, it would decelerate and two turbojets would extend to power the aircraft back to base.

Its RCS was reduced by changing the leading and trailing edges of the wing from straight lines to arcs of circles. To withstand thermodynamic heating caused by flying at such speeds, the steel honeycomb wings incorporated wedge-shaped inserts on both the leading and trailing edges constructed of Pyroceram – a ceramic material that was also impregnated with graphite to absorb incoming radar energy.

On November 12, 1958, Johnson presented his A-3 (A for Archangel) design, and Widmer FISH, to the Land Panel. Three days later the panel communicated their findings to Dr James Killian, the President's scientific adviser. Their recommendation was that FISH be selected due to Convair's superior RCS results.

On November 26 and over the next two months, Johnson and his team began working on designs designated A-4, A-5 and A-6. They included Frank Rodgers' idea of incorporating chines beginning at the nose that blended into the fuselage and merged into the leading edge of the

wings. Of small physical size, vertical surfaces were hidden above the wings.

However, in January 1959, before design studies had been completed on the A-6, Johnson instructed his team to work on a series of small, non-stealthy designs, designated A-7 through A-9. Powered by a single J58 turbojet and two ramjets, none of the designs were subsequently judged to be viable – their range was inadequate and, despite their small size, RCS values remained too great.

USAF ROLE

On December 22, Convair was given the go-ahead to proceed with a detailed design development of FISH but in May, a team from the Scientific Engineering Institute (SEI), a 'front' company set up by Bissell, completed a comparison evaluation between another design called the A-11 and FISH, and their report recommended Johnson's design to the Land Committee.

In the event it was Strategic Air Command (SAC) that determined the outcome of the competition.

In June 1959, senior Convair executives presented their B-58B design to senior air command officers. However, to make their earlier B-58A commercially viable, Convair desperately needed to sell more. The presentation went well, but when SAC were informed that it could purchase the B-58B only after it had first bought an additional three wings of A models the meeting ended abruptly.

The USAF never ordered the B-58B, consequently FISH, wouldn't be built either. Convair was subsequently instructed to completely redesign FISH as a single-stage platform that wasn't reliant upon a mother-ship.

On July 3, 1959, Bissell extended the Lockheed programme, agreeing to accept lower cruising altitudes of the A-11, provided its shape was adopted and treatment added to reduce its RCS. Johnson noted in his log: "I proposed the A-12, with J58 engines in a mid-wing arrangement, the use of chines on the fuselage and serrations on the leading edge incorporating radar treatment."

The Convair team now pulled out all the stops, remarkably working through design iterations designated Smelt, Herring and finally Kingfish in just over two weeks. When the two similar proposals were submitted on August 20, 1959 to a joint Department of Defence (DoD), USAF and CIA selection panel, they deemed Lockheed's A-12 design preferable in terms of overall cost. The Convair design was superior in terms of its lower RCS and was therefore favoured by some CIA representatives.

However, USAF members convinced them to support the Lockheed



The A-12 Oxcart programme validated the concept of manned, ultra-high altitude, tri-sonic, stealthy reconnaissance gathering – at least within the restricted theatre of operations its political masters were prepared to authorise. Lockheed Martin

design on the basis of costs overruns they'd experienced during the Convair B-58 project; whereas Lockheed had produced the U-2 under budget and on time.

Despite its vote in favour of Lockheed, the panel remained concerned about the A-12's inferior RCS results and required the Skunk Works to prove its concept for reducing these values by January 1, 1960. Gusto was terminated and the new programme received the classified cryptonym Oxcart.

On November 18, 1959, RCS testing began on a full-scale A-12 model at Area 51. Although still not released, it's believed that the RCS of an Oxcart was 12sq yards (10m²) at early warning radar frequencies (200 – 400 MHz) and 2.4sq yards (2m²) at air-to-air frequencies (10 GHz). Satisfied with the changes, Bissell notified Johnson that the CIA authorised the construction of 12 A-12s and the contract was signed on February 11, 1960. The Skunk Works original Oxcart quote of \$96.6m, however, proved optimistic, and during the protracted development period, costs spiralled to more than double the original figure.

On May 1, 1960, Soviet radar and surface-to-air missile (SAM) technology finally caught-up with the U-2 programme when, following the limited resumption of overflights, CIA pilot Francis Gary Powers, was shot down by an SA-2 *Guideline* while deep within the Soviet Union.

The action vindicated building a stealthy, high-performance U-2 replacement. However, Eisenhower assured Soviet Premier Khrushchev that there would be no more manned overflights during the remainder of his administration (an assurance upheld by every subsequent US President).

Consequently, by the time Oxcart became operational in June 1965, it was never authorised to execute the mission for which it had been designed and had in many ways become an advanced anachronism.

Instead, in May 1967, as the US became



SR-71s being built at Skunk Works in Burbank, California. Note how the fuselage forebody is joined to the wing section, optimising design flexibility. Shape is key to reducing the aircraft's RCS when exposed to long range surveillance radars – hence the engine nacelles are blended into the wing, the vertical tails are cantered inboard 15° and a chine is blended into the fuselage. The black components are constructed from RAM to further reduce the aircraft's RCS. Lockheed Martin

embroiled in the Vietnam War, three Oxcarts were deployed to Kadena AB on the Japanese island of Okinawa, from where they conducted operation Black Shield – reconnaissance-gathering missions, primarily over Hanoi.

As early as June 1959, the Land Panel had concluded that sporadic detection and tracking by radar was inevitable, regardless of the platform. They were right and Black Shield mission BX6705, flown on June 20, 1967, was the first occasion that an A-12 was successfully tracked by an enemy radar. During sortie number BX6732 on October 28, 1967, the pilot received indications on his radar homing and warning receiver (RHWR) display, of almost continuous radar activity focused on his aircraft and this culminated in the launch of a single SA-2 – which missed.

Two days later, during BX6734, the same pilot noted his RHWR receiver display indicated that two SA-2 sites were tracking

him and preparing to engage the Oxcart; but neither launched. However, during his second pass, while heading west and in the same area of Hanoi as earlier, he again noted he was being tracked on radar, then over the next few minutes, all hell broke loose and he counted at least six SA-2 detonations.

This would turn out to be the most determined attack ever on any of the 'Blackbird' family of aircraft, and although all the missiles were successfully jammed using electronic countermeasures (ECM), and missed their intended

target, a tiny fragment of missile debris was subsequently found during post-flight inspection. On January 4, 1968, during BX6842 the final SAM missile attack on an Oxcart occurred.

On this occasion, the missile was launched with its *Fan Song* missile control radar in low-pulse recurrence frequency (PRF). The aircraft's ECM equipment was activated and yet again the missile missed.

After just 29 operational missions, the Oxcart programme was terminated on May 16, 1968. Accountants within the US Bureau of Budget (BoB), questioned why two extremely expensive, almost identical programmes were being flown; one covert by the CIA, the other more overt (the SR-71, Senior Crown programme), by the USAF. The satellite age had also arrived and with it the CIA exited the world of tri-sonic manned reconnaissance.

The A-12 was the first operational aircraft to have been designed within specific RCS or stealth criteria; it also paved the way for the USAF's spectacularly successful SR-71 programme. However, it wouldn't be until the mid-1970s that the stealth conundrum would finally be cracked by the Lockheed F-117A Nighthawk, enabling a very low observable aircraft to interdict and survive within a sophisticated radar and air defence network without the need to carry any ECM equipment. **AN**

The Lockheed SR-71 built on the success of Oxcart, gathering simultaneous, synoptic coverage (photo, radar and signals intelligence), for the USAF, US Navy, US Army and other intelligence agencies for more than 30 years, before it was axed due to budget cuts in 1990. Lockheed Martin



FLYING THE F-117A PART 1 GOING TO WAR



Major General Greg Feest (Ret) describes joining the secret F-117A programme and the mission on which he dropped the first bomb of the Gulf War.

It was the early morning of January 17, 1991. I had just turned on the Master Arm Switch of my F-117 stealth fighter in order to drop a 2,000lb laser-guided GBU-27 on an Intercept Operations Centre hidden in a bunker in Iraq. How did I get here?

SWITCHING TO A NEW AIRCRAFT

In the summer of 1987, I had just walked back into the 27th Tactical Fighter Squadron (TFS) at Langley Air Force Base (AFB). I had returned from flying in a four ship of F-15Cs against a four ship of F-14s from Naval Air Station Oceana. I was still pumped up after our debrief when my Squadron Commander called me into his office. He told me I was being offered a position to go to Nellis AFB to fly with the



Greg Feest in the cockpit of an F-117. via Greg Feest

Above: **When Greg Feest was assigned to the F-117 in 1987 the aircraft was still in the black world.** Rich Cooper/COAP

4450th Tactical Group. I knew that they flew the A-7D Corsair and that most of their flying occurred at night. Other than that, there was little information on their mission. I drove over to the Personnel Section at Headquarters Tactical Air Command to visit with the "Fighter Porch" guys. They gave out the assignments to fighter pilots. I knew a Major in the section so I asked him about the 4450th. He immediately told me he was moving to Las Vegas to fly with them in a month. This was all I needed to know. Since the "Porch" fighter pilots give themselves the best assignments available, I knew it would be a great assignment.

He also told me that I would need to

meet several requirements to receive the assignment. I needed to be an experienced fighter pilot with over 1,000 hours of flying time and I needed to be an Instructor Pilot in a fighter. As an experienced Instructor Pilot, Flight Examiner and Flight Commander in the 27th, I met both requirements. However, he said that they recently added another requisite. The 4450th had lost two pilots due to spatial disorientation while flying at night during their bombing runs. Both of these pilots flew previous aircraft with only air-to-air missions. Therefore, they did not have any prior experience employing bombs at night. For this reason, the 4450th Tactical Group Commander had recently added the requirement that all future candidates must have bomb-dropping experience from a fighter. I immediately told him that I had dropped bombs off the F-111 as a Weapon Systems Operator but he told me that would not count since I wasn't a pilot at the time. I then told him I had dropped bombs off of the F-15C when we spent a year checking out

Three months later, I flew the stealth fighter for the first time. I flew solo, since there are no two-seat F-117s. It's just you and the aircraft. It was inspiring.

After my first flight I was given my 'Bandit number' – 261. Each F-117A Nighthawk pilot was given a sequential number in line with when they first flew the aircraft.

One advantage of the F-117 cockpit was its avionics. Most of it came from other aircraft and was familiar to the pilots. The engineers, after speaking with fighter pilots, put the displays and control boxes in the right place, making it easy for the pilot to operate. We had a head-up display (HUD) and the radios were in the right place. It was a good-sized cockpit, much like the F-15 with lots of space on both sides.

You can stretch your legs and lift yourself off the seat. It's very comfortable, especially on long flights. Everything was accessible with no need to reach down or behind.

The view from the F-117 cockpit was different. The view to the rear was non-

The F-117 was not a demanding aircraft to fly. Keeping the infrared cursors on the target while everyone was shooting at you was a challenge. We were well trained and, going into combat, our goal was to fly right over the target, drop a laser-guided bomb and get out. We couldn't launch and leave, but had to fly right into the threat. Our biggest initial concern was with the stealth technology. We didn't know if it was going to work. It obviously did, but those first few Desert Storm sorties were a little nerve-racking.

The F-117 was not built for aggressive manoeuvring like the F-22 or F-35. It didn't have afterburners and was strictly a subsonic aircraft. Our job was to limit any excessive manoeuvring, because any time you turned the aircraft, it changed the radar cross-section.

LIFE AT TONOPAH

From its inception in the late 1970s, until it was publicly acknowledged in November



An F-117 dropping the 2,000lb GBU-27. USAF/MSgt Edward Snyder

the bombing system of the F-15C Model. He said that was acceptable. Two months later I was off to Nellis AFB.

ENTERING THE BLACK WORLD

On arrival, I went to the squadron to meet my Squadron Commander and my fellow pilots. I was given a short introduction and briefing, which did not include any information about the F-117. Several days later, I found myself driving to Tucson to check out in the A-7 with the Arizona Air National Guard's 162nd Fighter Wing, which was responsible for training all guard pilots in the A-7.

My checkout in the A-7 took two months and, after completing my checkride, I headed back to Nellis. It was after returning to Nellis I learned the A-7 was just a cover story.

I was taken into a secure briefing room and was finally shown the aircraft I would be flying – the Lockheed F-117A Nighthawk. I needed some convincing that it could actually fly. After a short video, I realised it was a real aircraft and went from there.

existent, but we never planned to have anyone behind us! Visibility during the day was good, but at night any flashing lights reflected off the flat panels and that was a little disorienting, but you got used to it. Noise level in the cockpit was low. As your speed increased there was little change in the cockpit noise. You could actually accelerate without knowing it. It was that quiet.

The stealth fighter carried two, 2,000lb [907kg] bombs inside an internal weapons bay. Our primary weapon was the GBU-27, a modified GBU-24 designed specifically for the F-117. It was a laser-guided bomb with bunker-buster capabilities against hard targets. We found that the GBU-27 rarely had any failures and usually guided exactly where we aimed it. We would illuminate a target with a laser designator located inside our aircraft. The only condition for employing the GBU-27 was the maximum altitude. We had to fly below 10,000ft over the ground in order to employ the weapon. This became an issue for us later in Operation Desert Storm.

1988, only the personnel directly involved with the programme knew of the very existence of the F-117. It was considered a 'Black Programme' and was kept hidden in a secure, remote airfield in Tonopah, Nevada.

Although officially assigned to Nellis AFB, the F-117 pilots and support personnel would leave their families on Monday and fly on contract airlift from Nellis to Tonopah. There we flew only at night in a secret world, returning to Las Vegas typically midday on Friday to spend the weekend with our families.

Our families did not know where we went on Monday and we were not allowed to tell them. (I must confess that my wife was an active duty officer in the air force and she was also assigned to the 4450th Tactical Group). We didn't want to acknowledge the existence of the stealth fighter to any of our adversaries, so we kept it hidden in the black world.

There were some advantages and disadvantages to 'deploying' to Tonopah every week. We were home every weekend, so we couldn't run into the office or

bring work home. So weekend time was truly family time.

However, flying all week at night meant our body clocks were not aligned with our families. It was tough to switch to a daytime schedule on weekends after having flown at night all week. Our 'dorm' rooms at Tonopah had room darkening material taped over all our windows so we could not tell whether it was day or night when inside.

We could sleep during the day and work at night. Our medical folks told us that we needed to be in our rooms every morning before sunrise! They felt that our body clocks would be messed up if we were allowed to see the sun rise. Little did they realise that our weekends at home did not include sleeping during the day and never seeing sunrise.

DESERT SHIELD

By the time Iraq invaded Kuwait on August 2, 1990, the 4450th Tactical Group had become the 37th Tactical Fighter Wing. We were immediately told that our squadron, the 415th TFS 'Nightstalkers', would be deploying as soon as possible as part of Operation Desert Shield. Although the F-117 had come out of the black world in November 1988, we still were not in any war-planning deployment plans. Therefore, we did not fly out of Tonopah until mid-August and finally landed in Saudi Arabia on August 20, 1990. We first flew from Tonopah to Langley AFB. After getting some sleep, we took off the following afternoon and flew to our staging base in Saudi Arabia.

That flight took more than 14 hours and was the longest sortie I had ever flown. On arrival, we were met by our squadron brethren – they had deployed earlier in order to prepare for the arrival of the stealth fighters.



Ground crew working on an F-117. Rich Cooper/COAP

Unfortunately, they were not able to meet us with beer since General Order One stated no alcohol was allowed in the theatre. We made do with a bottle of water. Now we needed to get down to the business of planning our missions. We had no idea how long we would have before combat would begin.

It turned out we had almost five months to hone our skills and plan our first night missions. We spent the five months flying

'Do they really want me to release this weapon and start this war?'

training sorties in a desert environment that would be similar to Iraq. The picture from our infrared bombing system was not the same as we were used to while flying around Tonopah, Nevada.

We also practised everything without using communication over the radios. This included taxiing to the runway, taking off single-ship and joining as two ships when flying to the tanker orbit in order to air refuel. The only time we talked to other individuals

was over the inter-phone with the boom operator while taking fuel off the tanker. Once a week, we would fly with the tanker up to the Iraqi border in order to acclimatise the Iraqis to seeing us flying on the tanker's wing without actually being in 'stealth' mode. On January 16, 1991, things would change.

COMBAT

On the morning of January 16, I was told to stay in crew rest

and not come to the squadron until 1600hrs. Other pilots were told the same thing. We knew something was up and that there was a possibility we would be flying combat sorties later that night.

When we arrived at the squadron, we soon realised we were right. I attended the daily mass briefing with all the other pilots. In this briefing, we were given an intelligence update, weather update and, most importantly, our nightly mission folders that included our route of flight and photos of our targets. Scanning my target folder, I realised that tonight, my targets were in Iraq.

Several hours later, after having said goodbye to my wife, who was also deployed with our unit, I found myself strapped into an ejection seat of an F-117 taxiing to the end of the runway for my first combat sortie since Operation Just Cause [US invasion of Panama].

My heart was beating faster than normal. I made it through the arming procedure at the end of the runway, my wingman and I took the runway to lead the first wave of F-117 sorties into Iraq. Seconds later we were airborne.

We joined into formation and flew to our rendezvous point with the tanker. I topped off with fuel and received a few words of encouragement from the boom operator. Everything was proceeding as planned. After getting my fuel, I settled into my

An F-117 landing after an Operation Desert Storm mission. USAF/Tech Sgt Rose Reynolds



position on the tanker's left wing and prepared for our 90-minute flight to our drop-off point. My mind was racing.

Before taking off that night, nearly all of us pilots were wary of how well the stealth characteristics of the F-117 would protect us from radars that would direct thousands of Iraqi guns and surface-to-air missiles toward our flight paths. Since the Nighthawk's targets, including many in downtown Baghdad, were highly defended, wing leaders had privately prepared themselves for F-117 losses as high as 50% on the first night. We didn't know if stealth was going to work. The engineers all assured us that it would. We trusted them with our lives.

Having arrived at the Iraqi border on the tanker's wing, I flew into the refuelling position to obtain one last load of fuel. I wanted to have enough fuel to fly into Iraq, hit both my targets, and get back as close as possible to my staging base in Saudi Arabia, in the event I missed my tanker on the way home.

After getting a full load of fuel, things began to happen quickly. I based my departure off the tanker on timing. I had a time-over-target (TOT) of 0251hrs, which was nine minutes before H-Hour, the official start of the conflict. Before I departed the tanker, I put my F-117 into 'stealth mode'. From now until my return into Saudi Arabia after my target runs, I would be completely communications-out and could not talk or



Pre-flight checks of an F-117 in preparation for redeployment to the US after Operation Desert Storm. USAF/ Sgt Kimberly Yearyearn

hear anyone else. I was now alone!

Flying the lead F-117 to drop a 2,000lb GBU-27 bomb on to an Intercept Operations Centre (IOC). My objective was to take out the IOC which would control all the Iraqi fighters trying to intercept our non-stealthy coalition aircraft.

Hitting this target meant survival for many of my comrades. I crossed into Iraq and concentrated on flying my planned route to my target area. I identified my initial point (IP) before my target run and performed my bomb-run checklist. My laser was on and my bombs were armed. Every switch was set for a successful delivery.

During the bomb-run I did not look outside of the aircraft. My head was buried in the cockpit. I concentrated on finding my target, a hidden bunker, and delivering my GBU-27. I was 15 seconds from bomb release when I identified my target. My bomb would be the first of the Gulf War.

One last thought raced through my mind. Do they really want me to release this weapon and start this war? (I did not realise that Tomahawks had already been launched).

Seconds later, I hit the pickle button and my weapons-bay doors opened, the bomb was released and the doors slammed shut, all within five seconds.

I tracked my target for the next 30 seconds and watched my bomb score a direct hit into the bunker. I knew it did not fail when I saw the smoke blow out of the vent ports. The GBU-27 impacted on time, on target, marking the opening of the air campaign.

I started a 180° turn back to the west to fly the 150 miles to my second target, a sector operations centre (SOC).

Now things got hairy. As I turned my fighter back to the west, I looked out over my left shoulder to try to watch my wingman's bomb strike the same bunker I had just hit. His TOT was one minute after mine. When I looked back, I saw what appeared to be fireworks or some type of explosion filling the sky around me.

At first, I thought the bunker must have exploded, but I soon realised what I was seeing. I was watching the red tracers of the anti-aircraft artillery (AAA) and they were all heading towards me. This was the first time I had ever seen AAA. We talked about it during Red Flag training sorties at Nellis, but it was all just talk. This was the real thing. ►



Pilots from the author's squadron, the 415th TFS 'Nightstalkers', during Desert Storm. Major Feest is at the extreme left on the bottom row. via Greg Feest



Top left: **A row of F-117 with canopies raised following their return from Saudi Arabia where they took part in Operation Desert Storm. Mission marks are visible below the cockpits.** USAF/Sgt Mike Baquette

Above left: **A GBU-27 training round. The weapon was used by the F-117 on targets in Iraq.** Greg Feest

Above right: **The author thought the F-117's cockpit was well designed.** Rich Cooper/COAP



The lighting on this F-117 shows off to good effect the faceted design which made the aircraft stealthy. Peter R Foster

I snapped my head forward, pushed up the throttles as far as they would go and started a climb out of the heart of the AAA. A couple of minutes later, I realised I had made it out of the target area, but did my wingman as well?

I now had to get to my next target and deliver my second GBU-27. I looked out to the north of my route and saw Baghdad lit up with AAA and surface-to-air missiles (SAMs). I thought I was lucky since I was not headed into Baghdad but to the west to hit the SOC. My ease did not last for long.

I looked out to my next target area and over it, too the sky was lit up. I was going to fly into the biggest fireworks demonstration I had ever seen. Because of the delivery system of the F-117 at the time of Desert Storm, I had to be down low to deliver the GBU-27. I couldn't fly over the AAA, but had to fly into the heart of it. I was not sure I would make it out of the target area without getting hit.

As I approached my second target, I again performed my bomb-arming checks. I identified my target and once more watched my bomb score a direct hit and penetrate the SOC. Coming off the target, I again pushed the throttles as far forward as possible and started a climbing turn back towards Saudi Arabia. Now we would learn the value of the F-117.

As I approached the border of Saudi Arabia, I performed my de-stealth checks and extended my radio antennas. I could now talk and listen to the rest of our aircraft. It was a great feeling to no longer be 'alone'.

At a designated time, I checked in with my wingman. After several seconds, he

answered. Thankfully, he was okay and on his way to rejoin with me at our post-mission tanker. But who would not make it home? Who would have battle damage?

I had a kneeboard on my right leg which included the callsigns and names of all the F-117 pilots flying in the first wave. As I heard them check in, I placed a mark next to their names. After 20 minutes, I looked down and realised I had marked every name. We were all on our way home. The rest of the flight home was uneventful. I flew faster than normal. I was in a hurry to see my wife and congratulate all my fellow pilots.

'I was going to fly into the biggest fireworks demonstration I had ever seen'

After landing, every jet was inspected by maintainers for evidence of battle damage. No F-117 had been hit. I was relieved and somewhat happy that I would be spending the next evening in the mission planning cell instead of flying into Iraq.

However, this amazing achievement was repeated the next night. After the fourth night, with no aircraft receiving any battle damage, we all realised that stealth technology really worked. We were all begging to get back up into the air and fly as many missions as we could.

After 1,270-plus Desert Storm sorties,

not one F-117 ever received battle damage. Through the remainder of the Iraqi campaign, the F-117 would continue attacking the most difficult targets that required the highest degree of precision. Accounting for only 2.5% of fighter assets, the stealth fighter was credited with destroying a remarkable 31% of targets.

I would be remiss if I did not mention the unsung heroes of the F-117 programme. These were the air force maintainers, who spent countless hours ensuring stealth systems and coatings were kept pristine. They and all the support personnel at our staging base took care of all our living requirements, enabling us to concentrate on planning and flying our missions. My thanks to each and every one of them.

The F-117 programme was remarkable in essentially going from plans to first flight in only 31 months. In addition, it was successfully kept in the black world for a long time. This definitely gave us an advantage over the Iraqi military.

I think the taxpayer got their money's worth out of the stealth fighter. I was sad to see it retire. However, it's based on older, 1970s technology, and we possess much better capabilities today. People have asked me, what's your favourite aircraft? In peacetime, it's the F-15C – you can dogfight all the time. For combat, it's the F-117. Once we figured out the stealth technology worked, that was the aircraft for me. **AN**

NEXT MONTH: Part two gives more insights into the secretive world of the F-117 as the author becomes a squadron commander.

The almost out-of-this-world shape of the F-117 is clearly seen in this photograph of three aircraft. Rich Cooper/COAP



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WHAT MAKES THE B-2A STEALTHY



James C Goodall provides an insight into the stealthy design of the B-2A Spirit.

The first B-2A Spirit entered service with the USAF on December 17, 1993 and its distinctive bat-wing shape and capabilities have become imprinted on people's minds. The type serves with the 509th Bomb Wing and Missouri Air National Guard's 131st Bomb Wing, both located at Whiteman AFB.

The aircraft's success can be attributed to its ability to fly non-stop (with in-flight refuelling) to anywhere in the world without being detected and drop ordnance on

targets within a circle of error of less than two metres (2.18 yards).

The first B-2A was publicly displayed on November 22, 1988 after being rolled out of its hangar at Air Force Plant 42, Palmdale, California. Its first flight took place on July 17, 1989.

Whiteman AFB is the only operational base for the B-2A, the first aircraft arriving there on December 17, 1993. The Spirit has been used in combat over Kosovo as part of Operation Enduring Freedom as well as in Iraq, Afghanistan and Libya.

The overall design was the first stage of achieving a 'low observable' (LO) shape. In keeping with Jack Northrop's original 'flying wings', the B-2A sports exactly the same wingspan as his XB-35 and the YB-49 of 172ft (52.43m). The first XB-35 flew from Northrop's facility in Hawthorn, California, to Edwards AFB (then Muroc Army Airfield), California, on June 25, 1946.

LOW OBSERVABLE MEASURES

Looking at the bomber nose on, the first thing that stands out is the 'saw tooth' treatment on all the landing gear doors and other openings and panels on the exterior.

The shape of the leading edges all have the same angle, be it the 33° sweep at the front and back of the wing, to the rearmost points of the B-2A. These shapes are constant throughout the aircraft's design and are carried over to the inlets, bomb bay doors and the crew entrance ladder hatch and all external opening or panels.

Taking a closer look at the nose of the B-2A, the static pitot ports are visible. They tell the fly-by-wire (FBW) computers all the information the aircraft needs to fly, including airspeed, angle of attack (AOA) and pitch and yaw. If the B-2A were to use conventional static pitot tubes, it would light up every radar an adversary uses – so new LO designs were needed to still give the same input to the FBW computer as the non-LO counterparts.

The next area of concern in keeping the radar cross-section (RCS) to a minimum is the windscreen, which is huge – and there are many reflectors in the cockpit.

To reduce the amount of radiated energy entering the cockpit, the windscreen has a very fine gold mesh wire screen embedded, which acts as if the screen is opaque, with no radiated energy exiting the cockpit.

Looking down the leading edge of the B-2A, what becomes obvious is that it's anything but straight and it's very apparent that the leading edge is a series of ever-changing contours that reduce the amount of energy reflected back to an emitting radar. The leading edge of the early Block 10 and Block 20 B-2As were made up of several sections with seams. It wasn't until the Block 30 aircraft that the leading edge was all one piece and at this point the aircraft was deemed ready for combat. ►

Left: ***Spirit of Ohio*** performing a fly-by at an airshow at McChord Field on Joint Base Lewis-McChord, Washington. Norman Graf

Top right: **Nose on view of the B-2A's cockpit that shows the location of the static pitot ports in front of the cockpit windscreen and below the nose.** James C Goodall Collection

Above right: **The *Spirit of Pennsylvania*, AV-20 (93-1087) undergoes a thorough check after maintenance crews replaced several critical systems.** USAF

Right: **The shape of the leading edge of the wing is an ever changing radius that minimizes the amount of radiated energy that is returned back to the source. This photo shows the B-2 just prior to its first flight on July 17, 1989.** Air Force Test Center History Office





COMPUTER POWER

Shortly after his retirement in 1991, the author asked long-time friend, Ben R Rich, then the recently retired President of the Lockheed Skunk Works, why the F-117A Nighthawk and B-2A Spirit had different shaped surfaces. The Northrop B-2A technology demonstrator, Tacit Blue, was being developed about the same time as the F-117A yet the former has blended surfaces whereas the Nighthawk and Have Blue (the stealth fighter's technology demonstrator) are faceted. Ben said the answer was simple. It was all about computing power.

Six months after Lockheed froze the design of the F-117A, the company had the computing power to build and design a smooth and blended surface. He said he had to 'break the pencil' at some point.

On all aircraft, regardless of type, international law and regulations require anti-collision beacons on the wing tips and fuselage. The Lockheed Blackbirds (first-generation stealth) had retractable lights to protect them from being exposed to the airstream at 2,100mph (3,380kph).

The B-2A's anti-collision lights can be retracted to reduce the RCS. And, as you look more closely, even the wingtip lights have a distinctive diamond shape to align with the leading and trailing edges of the bomber's massive wing.

The trailing edge control surfaces all have finished stealthy edges, and even the hinge points have covers to help reduce

the RCS from the rear.

The aircraft's biggest infrared (IR) and RCS target is the exhaust ejectors. To help reduce the overall IR signature, a stainless steel woven screen was fitted instead of a titanium shield, which was prone to cracking.

The four General Electric F118-GE-100 non-afterburning turbofans are buried deep within the massive wing. To keep the engine exhaust and rotating parts from lighting up an adversary's radars, the efflux is funnelled through an 'S'-type exhaust ejector with no direct line of sight into the back of the engines.

The front of the B-2A has massive inlets

mounted on the top of the wing. As with the exhaust ejector, these are S-shaped and lined with radar absorbent material (RAM), preventing a signal from bouncing out of the inlet and giving away the bomber's location.

NO TAIL

In designing the B-2A, it became apparent early on that Northrop (now Northrop Grumman) had to go with a tailless, flying wing to meet the stringent RCS requirements outlined in the initial request for quotation (RFQ) issued by the USAF.

To get around the need for tails, especially for low-speed manoeuvres such



The B-2A doesn't have any vertical tails and at low speed, such as during take-off, the landing gear doors stay in the full open position to help with side slip and directional control. During combat missions the trailing edge split ailerons are fully closed and yaw is accomplished using only differential engine thrust. USAF

Even without the added Radar Absorbent Material (RAM) and special electrostatic coatings, the B-2A's frontal shape makes for a very small radar signature. USAF/
Senior Airman Tristin English



as take-offs and landings, the massive main gear doors act as a tail to prevent the B-2A from having problems with yaw.

The next focus was to reduce or eliminate hotspots on the aircraft's surface. These cause a spike in a radar return, so a special electrostatic coating was developed and applied by a robotic application system, neutralising the entire surface and removing hotspots or spikes.

The air force initially tested for RCS and electrometric hotspots by converting a former US Navy TA-3B Skywarrior used by Hughes, and then Raytheon, during F-14/Phoenix fire control system testing. It flew in formation with the B-2A, carrying a one-off radar system with antennas in ▶

Top right: **Technical Sergeant Steve Verner climbs out of the engine inlet of a B-2A after performing post-flight checks at Whiteman AFB in March 2003. The bomber had just returned from a combat mission over Iraq in support of Operation Iraqi Freedom.** USAF/ Tech Sgt Michael R Nixon

Above right: **To counter the effects of exhaust heat, the B-2A community has retrofitted its 20 aircraft fleet with a woven stainless steel exhaust ramp at the aft end of the exhaust ejector. This allows for cooling bleed air to past up through the exhaust ejectors ramp and spread the heat over a larger area for cooling.** James C Goodall Collection

Right: **The computer-controlled painting robot applying a special electrostatic coating that eliminates all static and electrical hot spots on the surface of the B-2A. This process is done when an aircraft has undergone a complete overhaul.** James C Goodall Collection





Top: Once the B-2A was built there needed to be a way to validate its RCS in the air. To accomplish the job of verification, a former US Navy NTA-3B Skywarrior was modified with very high-resolution radar, both in the nose and tail radome linked to a system called 'Skyball'. This was a high-definition TV camera slaved to the radar antenna for precise location tracking looking for hot spots and spikes in the radar return. James C Goodall Collection

Above left: The secretive NT-43A testbed that is used for airborne air-to-air radar and infrared signature testing on stealthy aircraft. USAF

Left: This underside view of the B-2A with its very distinctive 'sawtooth' trailing edge. The trailing edge and the leading edges all share the same sweep. Key Collection



its nose and tail linked to a high-definition steerable TV camera, slaved to the antennas.

When a hotspot or a large RCS spike was detected, it tagged the image with the exact location that caused the spike. B-2A maintenance crews then manually carried out repairs, bringing the bomber back to its lowest RCS signature.

The Skywarrior flew in a 360° loop circling the B-2A. The aft-facing radar 'painted' the front of the Spirit and as it moved around the bomber the nose-mounted radar scanned the B-2A's trailing edge.

Due to age of the NTA-3B Skywarrior (the 'N' prefix was used to designate it as new and as a training aircraft), and lack of a parts network, it retired in 2000 – a highly modified Boeing 737-200, NT-43A (73-1155) now performs the same function. This procedure is now performed on a B-2A whenever there is overhaul work performed on the exterior of the aircraft.

Above: The auxiliary doors on top of the wings and next to the inlets are only opened during take-off to allow for additional air to enter the inlets. Also visible is the all-moving 'Beaver Tail' which is used to dampen loads on the B-2A when flown during turbulent low level flight. Key Collection

Below: A side view of the B-2A with its very distinctive 'Parrot's Beak' nose profile. The shape of the nose area is designed to reduce any electrostatic hot spots when viewed head on. Key Collection

'BLUE LINE'

The B-2A has very few external openings, and equipment or systems are either accessed through the cockpit or the nose wheel well. This reduces the need to open up external panels and keeps the bomber mission-ready and out of the LO shop.

As simple as it may sound, the best way to be undetected is to avoid hostile radar and SAM sites using the 'Blue Line' – a key part of stealth tactics that's just as

vital as the aircraft's design and the secret materials reducing radar cross-section.

Uniquely crafted for each mission, the 'Blue Line' stitches assigned targets on to a flight path calculated to avoid the most dangerous defences. Surviving a mission depends on intense planning before take-off.

The final item on the list of 'How to reduce your RCS' is the low probability of intercept (LPI) radar used on the B-2A and other LO platforms. The bomber's Hughes – now Raytheon – AN/APQ-181 radar uses frequency jumping for every pulse of the radar, sending out on one frequency then jumping to another, making it virtually impossible to detect.

Combined with its stealthy characteristics, by flying a profile that avoids hostile radars and SAM sites, at night and at high altitude, this huge flying wing is all but invisible to most current air defence systems employed throughout the world. **AN**





RETURN OF THE RAPTORS

USAF F-22A Raptors undertook a training deployment to RAF Lakenheath in October, as **Darren Willmin** of Aviation in Action reports.



Six more Raptors arrived at RAF Lakenheath on October 17. They flew in on their way home to Langley AFB, Virginia at the end of a deployment in the Middle East. Dino Carrara

The 48th Fighter Wing (FW) at RAF Lakenheath recently hosted six Lockheed Martin F-22A Raptors on a flying training deployment (FTD). They arrived on October 8. This was the type's first appearance at the Suffolk base since 12 F-22As from the 325th FW at Tyndall AFB, Florida visited in April 2016.

The latest aircraft were stopping off on

their way home from a six-month operational deployment to the Middle East. The aircraft had been in the Gulf region with the 27th Fighter Squadron (FS) which returned home, while the aircraft were flown in Europe by the 94th FS. These units both belong to the 1st FW at Joint Base Langley-Eustis in Virginia.

While in Britain, the Raptors worked with the 48th FW, RAF and other NATO nations.

The main focus was for the fighters was to participate in Exercise Eastern Zephyr, led by the Typhoon Qualified Weapons Instructor Course on 29(R) Sqn at RAF Coningsby. An RAF spokesperson confirmed it was designed to strengthen the partnership and capabilities between the US and UK, while also bringing large numbers of fourth- and fifth-generation



Two Raptors visited Spangdahlem AB during the European deployment. USAF/Staff Sergeant Jonathan Snyder



A Raptor prepares to taxi for a sortie at RAF Lakenheath. USAF/Airman 1st Class Christopher S Sparks

aircraft operating together in UK airspace. Eastern Zephyr was a chance to develop and refine fighter integration at the tactical level with both the F-22A Raptor and Typhoon. The 48th FW's F-15C Eagles and F-15E Strike Eagles also took part in the exercise.

Lt Col Cody Blake, 493rd FS Commander, said: "Any time that we get the opportunity to train with our partners, it provides invaluable lessons on how to work together on a specific mission set but more importantly it sends the message to the region and to the world about our shared commitment to a secure Europe."

The deployment was also important for the 94th FS due to its historical ties with the RAF. Squadron commander, Lt Col 'Habu' said: "For a century now, the 94th Fighter Squadron has had a close relationship with our Royal Air Force friends and partners

beginning with 'The Hat-in-the-Ring Gang's' [an early nickname for the 94th Aero Squadron] first deployment to the United Kingdom in 1917 prior to operations on the Western Front during World War One." He said that over the course of this year's exercise, familiarisation training across the UK had been undertaken, along with multiple, large-force exercises involving up to 40 aircraft at one time.

The USAF also took the opportunity to 'flex its muscles' while the aircraft were in Europe. There were forward deployments to Spangdahlem AB in Germany and Powidz AB, Poland. On both deployments, two F-22A Raptors were supported by ten airmen and equipment, plus a KC-135R Stratotanker from the 100th Air Refueling Wing at RAF Mildenhall. The aim was to demonstrate an ability to quickly respond and reassure allies. Additionally, it served

to enhance the US deterrence posture in Europe.

Gen Tod D Wolters, Commander, US Air Forces in Europe, said: "The deployment of fifth-generation combat aircraft to the European AOR [area of responsibility] is a concrete example of how the US is engaged, postured and ready with a credible force to assure, deter and defend in an increasingly complex security environment."

A further six 1st FW F-22As arrived at RAF Lakenheath on October 17 from the Middle East, having been relieved by the 325th FW. It took the total number on base up to 12.

The additional aircraft were not taking part in the flying training deployment, but joined their compatriots in departing the UK for home in two cells of six on October 19 and 20. **AN**

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QUEENSTOWN

GATEWAY TO SOUTH NEW ZEALAND

Alan Howell heads to the far south of New Zealand to profile a growing airport that serves this remote and picturesque region.



Queenstown Airport is perfectly placed on New Zealand's South Island to serve increasing numbers of tourists attracted by the spectacular mountain scenery of the Southern Lakes area of the Otago region.

The airport (ICAO: NZQN) is on alluvial flats at the head of an arm of Lake Wakatipu, the island's second-largest lake. Surrounded by high, rocky peaks, it offers stunningly scenic views in good weather to arriving and departing passengers. For pilots it's a challenging destination – especially in poor visibility – with high terrain in close proximity on all approaches.

The airport is a ten-minute drive from the resort town of Queenstown, which has developed a worldwide reputation as a

An Air New Zealand Link ATR 72-600 taking off from Queenstown Airport. Queenstown Airport Council/Bill Wrigley

centre for winter sports and adventurous outdoor leisure activities. There are four winter ski areas within an hour-and-a-half's drive, and the community has successfully broadened its tourist offering with a range of cultural and sporting activities and events throughout the year to supplement the basic attractions offered by the landscape.

There's been a symbiotic link between the development of the resort (and region) as a destination and the evolution of the airport – which has seen a significant increase in passenger numbers in recent years. In 2005 there were just over 4,000 scheduled arrivals and by 2016 this had

increased to almost 7,000. In the 12 months to June 2017 the airport handled 1.9 million passenger movements, making Queenstown New Zealand's fourth-busiest airport by passenger numbers.

ORIGINS

A licensed airport at Queenstown has existed since 1935, but the first aircraft arrived on January 4, 1931 – a Simmonds Spartan, ZK-ABK, belonging to New Zealand Airways, which landed on Frankton racecourse having taken off from what is now Wanaka Airport. It stayed at Queenstown for several days, offering pleasure flights to locals.

In the mid-1930s, the Queenstown Mount Cook Tourist Company applied for an air taxi



Above: **An aerial view of the terminal complex in August 2017.** Queenstown Airport Council/Bill Wrigley

Below: **Aircraft representing Virgin Group airline Polynesian Blue, Jetstar, Air New Zealand and Qantas, clustered around the terminal in 2010.** Queenstown Airport Council



licence to operate to various South Island locations, including Queenstown which took a while to process.

The owners of the company acquired a Waco QDC biplane from the Otago Aero Club, which was soon put to use operating scenic flights out of Queenstown to Milford Sound and back. In the year to March 31, 1939, a total of 719 passengers were carried on 291 trips. The company also advertised a charter service to “anywhere” in South Island.

Queenstown - Mount Cook Airways continued to operate until early 1940 when World War Two halted proceedings. The venture had been successful, gaining valuable experience operating in the alpine environment which would benefit ventures

The continuing attraction of Queenstown as a winter sports destination is borne out by the year-on-year expansion of airport arrivals, particularly trans-Tasman Sea traffic from east coast Australia’

at war’s end. Clearly, there was a future for sightseeing trips around the spectacular glaciated landscape, with its mix of mountains, valleys, lakes and fjord coastline.

Southern Scenic Air Trips (later Services) set up at Queenstown in 1947 using an Auster Autocrat and a Percival Proctor; the first official flight, freighting whitebait from the coast in the Auster, being made on September 8.

From the outset the company wanted to run scheduled operations and sought a licence to run a Queenstown-Dunedin return service throughout 1949 and into 1950. After initial reluctance to allow a private operator to compete against the New Zealand National Airways Corporation (NAC), Southern Scenic won approval for ▶

the route and flew the first service on July 17, 1950.

It ran until April 1962, initially using Austers and Proctors, an Anson for a short time and finally DH-89 Dominies.

From 1951 the company also ran scenic flights from Queenstown to Milford Sound, which became a mainstay of the operation. In 1965 it merged with another of the pioneering New Zealand airlines, Tourist Air Travel, and the Queenstown sightseeing operation was sold. In 1968 Tourist Air Travel became a part of Mount Cook Airline which had restarted after the war, though without the original Queenstown prefix to the name.

The contributions of New Zealand's early commercial operators, such as Southern Scenic, Ritchie Air Services, West Coast Airways, Tourist Air Travel and Mount Cook Airline, were commemorated at a 70th anniversary reunion at Queenstown Airport



A Jetstar Airbus A320-214 landing at Queenstown. Queenstown Airport Council/ Michael Thomas

in April this year.

Surviving personnel from those early operations attended the event, along with preserved Dominie ZK-AKY, still licensed and available to carry sightseers as it was when owned by Mount Cook and Southern Lakes Tourist Company.

Mount Cook Airline used DC-3s to begin scheduled flights from Christchurch

to various South Island destinations in the early 1960s. Initially, Queenstown was not certified for DC-3 operations and passengers were bussed to their destination from Cromwell. The first scheduled flight into Queenstown was flown by DC-3 ZK-BKD on February 4, 1964 after the grass runway had been extended to 1,500m (4,921ft) and

the field licensed.

A process of upgrade and development started in the 1960s – driven by the needs of accommodating more modern aircraft, growing passenger numbers and improved safety requirements. In 1968, 1,341m (4,400ft) of the original 05L/23R runway was paved enabling Mount Cook Airline to introduce turboprop HS748 services that same year (there was a parallel grass runway with the opposite [L] and [R] designations).

IMPROVED FLIGHT PATHS

In 2012, Airways introduced ground-breaking new performance-based navigational technology at Queenstown, which would be key to the subsequent dramatic and continuing growth in passenger traffic.

Called Required Navigation Performance, Authorisation Required (RNP AR), it uses instruments and satellites to facilitate travel on any flight path, using shorter routes and avoiding obstacles.

RNP AR makes for easier operation in mountainous terrain and bad weather and has been a game changer at Queenstown, effectively doubling its air traffic capacity.

The key advantages are:

The airport can now deal with up to 12 aircraft an hour in poor weather, up from five per hour.

All airlines are benefiting from greatly reduced delays – down from around 40 hours a month to little more than five a month.

The revised RNP AR departures have led to a significant increase in take-off payload. Airways can safely handle more than double the traffic with no requirement for strategic separation of arrivals from departures.

Airline operators' punctuality has improved, while holding delays, fuel burn and CO₂ emissions have all seen significant reductions.

The international and domestic jets of the four jet operators at Queenstown – Air New Zealand, Qantas, Virgin Australia and Jetstar – are all now equipped with the technology and Air New Zealand has committed to spending more than \$25m extending it to its turboprop ATR fleet. Pending certification, the first of these is due to enter service in 2018, when the carrier will be the first ATR operator in the world to use the system.

The Air New Zealand-liveried ATRs used on the regular Christchurch-Queenstown service are still operated by Mount Cook Airline, which became a wholly owned subsidiary of Air New Zealand in 1991.



Panoramic view of the mountain backdrop with Air New Zealand, Jetstar, Virgin Australia and Qantas jets on the apron. Queenstown Airport Council

Qantas Boeing 737-838 VH-VXD powers out of the airport past the mountains that attract so many Australian winter sports enthusiasts each year.

Rob Neil



Ansett New Zealand brought the first jets in 1989, operating the BAe 146. One ran off the end of the Queenstown runway in April 1990, though it was not seriously damaged.

The runway was subsequently lengthened in 1995 and again in 1998 to a length of 1,911m (6,270ft). This enabled fully laden Boeing 737s to operate to any New Zealand or southern Australia destination.

The early 2000s saw further developments, including a resurfaced runway and a new terminal building which opened in 2001. Since then, there's been steady growth.

OWNERSHIP

The original 1935 request to open an airport at the old Frankton Racecourse site had been made by a consortium of local councils which proposed the

establishment of a trust to run the airfield. In effect, a similar arrangement still exists, the operator being Queenstown Airport Corporation (QAC) running it on behalf of its shareholders – Queenstown Lakes District Council (QLDC) which holds 75.01% and Auckland International Airport the other 24.99%.

Queenstown Airport Corporation was incorporated in 1988 but the strategic partnership with the operator of Auckland Airport only dates from 2010 – the partnership share issue raising NZ\$27.7m.

Until relatively recently, Queenstown airport did not have runway lights so after-dark operations were impossible. Its first such lights were switched on in July 2011 – financed by Airways, New Zealand's air navigation service provider. It was the last major airport in New Zealand to have such an upgrade.

Other improvements in 2011 included completion of a NZ\$5m runway extension safety area and the 14/32 grass cross runway was paved at a cost of NZ\$800,000.

Operations in darkness began last year when Air New Zealand landed the first domestic evening flight on May 23, 2016 – and Jetstar Airways the first international evening flight on June 24.

FACILITIES

Improved facilities to cope with rapidly increasing passenger numbers culminated in the opening of an expanded international area of the terminal, 20 years to the day after the first international flight landed on July 1, 1995.

The NZ\$17m expansion was built in nine months. At 44,300 sq ft (4,100m²), it doubled the size of international operations and increased the terminal footprint by ►



A low sun through broken cloud illuminates the main runway in spectacular fashion. Queenstown Airport Council/Vaughan Brookfield



Above left: **Plenty of activity as the winter ski season gets under way: Queenstown Airport terminal concourse in May this year.** Queenstown Airport Council/Michael Thomas



Above right: **Loading ATR 72-12A ZK-MCY which bears both Air New Zealand and Mount Cook Airline titles.** Rob Neil

a third offering vastly improved facilities. Scope for future expansion was built in: a mezzanine was included with this in mind, allowing for the introduction of air bridges, new gate lounges or expanded retail offerings.

The continuing attraction of Queenstown as a winter sports destination is borne out by the year-on-year expansion of airport arrivals, particularly trans-Tasman Sea traffic from east coast Australia. On average there are around 60 direct flights a week in the peak winter season, and all four of the airport's operators that use jets – Air New Zealand, Qantas, Virgin Australia and Jetstar – service the routes, from Sydney, Melbourne, Brisbane and the Gold Coast, using Airbus A320s or Boeing 737-800s.

Domestically, Air New Zealand and its feeder service, Air New Zealand Link (operated by subsidiary Mount Cook

Airline), offer services to the international hubs of Auckland, Wellington and Christchurch, while Jetstar Airways (a low-cost subsidiary of Qantas) also flies to Auckland. Airbus A320s ply the Auckland route and a mix of A320s and ATR 72s fly to Wellington and Christchurch.

Scenic flights are still very much part of the Queenstown offering. Weather permitting, both fixed-wing and rotary operators ferry visitors to the principal destinations of Milford Sound and Aoraki Mount Cook. Companies offering this are Air Milford, Glenorchy Air, Glacier Southern Lakes Helicopters, Heli Tours Queenstown and Alpine Adventures.

Queenstown claims to be the busiest helicopter base in New Zealand, its annual report listing 13,606 landings in the year ending June 2017 – up 12% on the previous year.

Meanwhile private jet landings were up 14% at 243. This is also seen as a future growth area, encouraged by the establishment of Queenstown Corporate Jet Services unit in 2014 with dedicated facilities to welcome, host and process up to eight passengers and crew.

The airport's annual report to June 2017 shows the contribution made to the local economy, with a return of NZ\$7.2m made to the two shareholders, Queenstown Lakes District Council (QLDC) and Auckland Airport. For majority stakeholder QLDC, that meant a dividend of NZ\$5.4m.

Underlying profit for the year was NZ\$12.3m, up NZ\$1.8m (or 17%) on the 2016 figures. These returns, taken with other performance indicators, demonstrate that the sky's the limit for Queenstown Airport, as long as tourists continue to flock to this picturesque area. **AN**

Author's note

This article was originally planned to be written by a regular contributor to *Aviation News*, Geoff Jones, who sadly died earlier this year. He was inspired to tackle the subject when we passed through Queenstown together at the start of our journey home, following a New Zealand tour in 2016. As a friend, he offered me the opportunity to write the article when it became clear he could not. I have done my best to honour his intentions and his memory.



A Qantas Boeing 737 on finals for Runway 05. Queenstown Airport Council/Michael Thomas

ROYAL BRUNEI AIRLINES

SMALL AIRLINE, BIG AMBITIONS



Jozef Mols traces the development of Royal Brunei Airlines which is challenged by a small home market.

Brunei is a small sovereign nation on the island of Borneo. It has a population of about 430,000 people, living in an area slightly larger than the English county of Norfolk.

Royal Brunei Airlines' (RBA) success reflects its geographic position in the middle of the world's fastest growing economic region, standing at a potentially lucrative crossroad between Australia, its Asian neighbours and Europe. The carrier is state-owned by a government with huge reserves of oil wealth, and it also has the close interest of the Sultan of Brunei, one of the world's richest royals.

Singapore Airlines has demonstrated that the size of an airline's home market does not automatically limit its growth, or financial success, provided the political and economic infrastructure exists to enable it to exploit its location.

The Boeing 787-8 Dreamliner was introduced to the Royal Brunei Airlines' fleet in 2013.

AirTeamImages.com/BastianDing

EARLY DAYS

Before the airline's establishment in November 1974, foreign operators brought business people to the country. Local services were provided – on an irregular basis – by the Askar Melayu Diraja Brunei (Armed Forces of Brunei).

Expatriates from Europe and Australia helped in the foundation of the company, which is entirely owned by the government. Initially, the fleet consisted of two new Boeing 737-200s with the maiden flight on May 14, 1975 from the country's newly built international airport to Singapore. Services to Kota Kinabalu and Kuching, both in Malaysia, and Hong Kong followed. Early route expansion included flights to Manila in 1976 and Bangkok in 1977.

Three years later, Royal Brunei acquired a 737-200 Quick Change. The extra aircraft enabled it serve Kuala Lumpur in 1981 and Darwin, northern Australia, in 1983.

After independence from the United Kingdom on January 1, 1984, services started to Jakarta on January 3, forging a link to all five ASEAN-capital cities (Association of Southeast Asian Nations) at that time – Bangkok, Jakarta, Kuala Lumpur, Manila and Singapore.

In the mid-1980s, three Boeing 757-200s were acquired, which enabled the airline to expand to serving Taipei and Dubai in 1988. They were also used on routes where the higher capacity was useful, such as to Singapore and Hong Kong. According to Boeing, the 757s were luxuriously appointed, with a 42in (107cm) seat pitch in economy and gold-plated fittings in First Class, not to mention



The airline's initial fleet consisted of two Boeing 737-200s, with the first flight taking place in May 1975 to Singapore. Wikimedia Commons Licence/Doug Green

the 'superloo' with gold-plated basin and surrounds.

This design fully reflected the business's 'low volume, high yield' approach which was dictated by the geographical location of the country. There is little tourism infrastructure to attract large numbers of low-yield passengers, which could supplement the small home market.

FURTHER AFIELD

In 1990, services to Europe were started with a Brunei-Frankfurt flight, via Bangkok and Dubai. In the same year the 737s were phased out.

Flights to London Gatwick via Singapore and Dubai followed soon afterwards, and switched to London Heathrow in 1991. Jeddah, Saudi Arabia, and Perth were added that year, allowing UK-Australia services to be offered.

In the same period, the operator added two Fokker 50s to its fleet, to serve Miri and Labuan in eastern Malaysia: two destinations important to the growth of the country's oil and gas industry. These aircraft were later replaced by two Fokker 100s,

obtained from Swissair, being sold in 1998 to the Italian firm, Alpi Eagles.

When further expansion of its European operations was contemplated, the introduction

***'the 757s
were luxuriously
appointed, with
a 42in (107cm)
seat pitch in
economy and
gold-plated fittings
in First Class,'***

of the Boeing 767 was mooted. As no aircraft were available from Boeing at that time, a 767-200 was to be leased from Ansett (while awaiting delivery it was decided to purchase

it), which in turn had obtained the aircraft from Olympic Airways.

There was no time to adapt the interior to RBA standards and the aircraft began its new life in a two-class Olympic Airways cabin design. An initial journey was for the annual Haj charter, bringing back Muslim pilgrims from Mecca.

The performance of the leased aircraft led the company to order three 767-200ERs from Boeing. The first broke a world record when it flew 17hrs and 22mins from the factory in Seattle to Jomo Kenyatta International Airport in Kenya, on its way to Brunei. From 2000 onwards six 767-300ERs joined the fleet. One of the 757s was sold to help fund the purchase of 767s.

In March 1993, Abu Dhabi was added to the network and flights to Frankfurt and Jeddah were rerouted through the Red Sea port city, instead of Dubai.

Bali became the second Indonesian destination to be introduced. Flights to more European destinations, including Zürich, via Kuala Lumpur and Bahrain also began.



In the mid-1980s the airline started operating three Boeing 757-200s. Wikimedia Commons Licence/Montague Smith



Before the end of the year, services had been inaugurated to Beijing (in October) and Cairo (in November) via Kuala Lumpur and Bahrain. Negotiating traffic rights remained a serious problem for RBA as the airline had little to offer in return. The problem was the limited population of the country and the lack of tourism infrastructure.

In 1994, two Dornier 228s were purchased and leased to the Malaysian regional carrier Hornbill Skyways. They connected Brunei by air to Mulu Airport, Sarawak. One of these aircraft crashed into high ground near Miri Airport on September 6, 1997 killing all ten people on board. It was the company's first major accident.

Until then, it had never had to cancel a flight due to the technical condition of an aircraft. All short-haul operations are entirely 'out and back', meaning every flight returns to base where any problems can be fixed.

In the early 1990s, Fokker 50s were used by Royal Brunei Airlines on flights to nearby Malaysia, particularly serving the oil and gas industries. Thys Postma Collection

Thanks to this policy, the company was able to obtain high prices whenever it sold its used aircraft. When Aloha bought a 737, for example, RBA received more money than it had paid to buy the aircraft.

RESTRUCTURING

Since its establishment, Royal Brunei had never been profitable. The only shareholder (the government) could easily afford to compensate for the losses, but officials demanded a restructure.

In September 2002, Peter Foster became CEO to carry out the task. Changes began in 2003 and the intention was for the fleet to grow from nine to 24 aircraft before the end of 2013. The plan included the start of new services to Auckland, Ho Chi Minh

City, Sydney, Seoul and Tokyo. The fleet of Boeing 767s would be changed to 15 new narrowbody aircraft.

In 2003, two Airbus A319s and two A320s were delivered, leased from CIT Aerospace in the US. The Boeing 757s were phased out and sold (one was leased to Royal Tongan Airlines and later repossessed). Although Foster initially planned to replace widebody jets with narrowbody aircraft, the 767s were modified in 2004 by the introduction of SkyDreamer seats in Business Class to replace the old First Class and Business Class Skyluxe seats.

As well as starting new routes, Royal Brunei also dropped loss-making destinations including Taipei, Kuching (Malaysia) and Kolkata. Instead, Sydney and Sharjah, the Gulf, were added to the network.

In August 2005, Foster resigned as CEO to take up a similar job with another ►



Fokker 100s, obtained from Swissair, replaced the Fokker 50s on short-haul flights. Thys Postma Collection



operator. Ray Sayer took over but lasted for only 20 months to be replaced by Robert Yang, who resigned in 2011.

Flights to Frankfurt were suspended in 2007, as they were not profitable, followed by operations to Darwin and Sharjah in 2008.

In June 2010, the first Boeing 777-200ER (leased from Singapore Airlines) was introduced, starting operations on a Brunei–Dubai–London service. A total of six leased 777-200ERs would enter the fleet which were mainly used on Asian routes. These were phased out between October 2013 and April 2014 in favour of 787 Dreamliners.

On June 21, 2012, the company announced it would once again implement a plan to improve operations, financial performance and customer care. Figures had improved slightly but not enough, according to RBA Deputy Chairman, Dermot Mannion. Loss-making flights to Auckland, Brisbane, Perth, Ho Chi Minh City and Kuching were suspended.

The average load factor on flights increased to just above 70%. In an effort to

A Royal Brunei Boeing 767-300ER at London Heathrow Airport. The type's introduction facilitated the expansion of European operations. Jozef Mols

revitalise the regional network two additional A320s were leased in 2013.

The first of the Boeing 787-8 Dreamliners was delivered on October 4, 2013. Dreamliner flights to London Heathrow via Dubai started on December 2, 2013. Four are in service with another on order.

On May 5 the following year, a contract was inked with Airbus covering the firm order of seven A320neo aircraft, plus three options as part of a fleet modernisation programme.

A milestone was marked in 2016 when a codeshare agreement was signed with Hong Kong Airlines, leading to more flights to China and Japan. Agreement was reached with a Chinese tour operator for weekly direct charter flights between Brunei and Xi'an, which is home to the world-famous Terracotta Army.

At the same time, RBA gave Chinese tourists direct flights to the tropical rainforests and dive spots in Brunei and nearby Borneo.

Nearly simultaneously, another charter agreement was signed, this time with a South Korean travel agency, for twice-weekly A320-flights between Brunei and Incheon.

In early 2017, the CEO Karam Chand declared the company would start serving Beijing from December 2017. They will be twice-weekly and move to thrice-weekly as soon as possible.

The carrier flew to Beijing two decades ago, but flights were cancelled soon afterwards. Now that business ties with China have grown, a new start makes sense.

To further expand its regional network, a codeshare agreement was arranged with Philippine Airlines on flights to Manila and Cebu. An existing agreement with Malaysia Airlines was enhanced, enabling passengers to fly to new destinations in Peninsular Malaysia, including Langkawi, Penang, Alor Star, Kota Bahru and Johor Bahru. A similar arrangement with Turkish Airlines was also improved, meaning passengers could connect seamlessly from Brunei to Istanbul via Dubai.



The first Boeing 777-200ER for Royal Brunei entered service in June 2010.

[AirTeamImages.com/Steve Flint](http://AirTeamImages.com/Steve_Flint)



THE OUTLOOK

What is the outlook for the future of Royal Brunei Airlines after several restructuring phases and many changes at the top? The residual issue of being the flag carrier of a very small country, with a limited home market will remain. That was also the problem for Singapore Airlines, which nevertheless became a major player.

Brunei's strategic location is now being bolstered by a push to increase tourism, selling it as a holiday destination or an ideal stopover. A new partnership between the tourist board and the airline to promote the destination should lead to load factors significantly increasing.

The restructuring, rebranding, service enhancements and fleet simplification, combined with the introduction of a new yield management policy, has the potential to establish a profitable, full-service carrier in the future.

The introduction of the 787 has brought about significant improvement to the long-haul product, while reducing cost. The introduction of new A320neos will help enhance the short-haul offering.

An 18% increase in seat capacity (and a 50% increase in premium seat capacity), due to the introduction of the new Airbus aircraft will give the airline the opportunity to expand in the competitive Asian market.

The short- and medium-haul routes are currently profitable, but long-haul routes are making a loss. This will probably continue to be the case for some time, unless the tourism department and the airline can manage to increase the number of visitors to Brunei. **AN**

Above left: **Cabin crew sporting the recently introduced uniforms.** Royal Brunei Airlines

Left: **The economy class cabin in the 787-8 Dreamliner.** Royal Brunei Airlines

Below: **The Airbus A320 came to the fleet in 2002, leased from CIT Aerospace.** Dr Frikkie Bekker



REGISTER REVIEW

The latest changes on the UK, Irish, Isle of Man, Guernsey and Jersey registers.



New Ryanair Boeing 737-800 EI-GDB at King County International Airport (also known as Boeing Field). Tony Dixon

RESTORATIONS

REG'N	MODE(S)	TYPE	C/N	OWNER
G-AFZE	407461	Heath Parasol (built by RH Parker)	PA1	CJ Essex, (Coventry, West Midlands)
G-ANJL	406D5D	de Havilland DH.82A Tiger Moth	85099	D Shew, Malshanger, Hampshire
G-AWDA	401778	Nipper T.66 RA45 Series 3 (built by Slingsby Aircraft Co. Ltd)	S117	H Abraham, (Zurich, Switzerland)
G-BJXA	401FF3	Slingsby T.67A	1994	PK Pemberton, Blackpool, Lancashire
G-BRZF	4030ED	Enstrom 280C	1163	M Richardson, (West Hallam, Derbyshire)
G-BTYY	403512	Curtiss C-2 Robin (modified)	475	RW Hatton, (London N6)
G-BULY	40368E	Light Aero Avid Flyer (modified) (built by MO Breen)	PFA 189-12309	C Coleman, (Godalming, Surrey)
G-BVYS	4005C4	Avro RJ100	E3259	Tronosjet Maintenance Inc, Summerside, Canada
G-BXIW	403E1D	Sky 105-24	073	AGA Barclay-Faulkner (Hopton, Staffordshire)
G-CCGA	407430	Medway EclipseR	175/153	G Cousins, Middle Stoke, Kent
G-MVYZ	402FA4	CFM Shadow Series BD (Modified)	121	DH Lewis, (Nelson, Mid Glamorgan)
G-OBAP	40658F	Zenair CH.701SP STOL (built by JM Gale & AD Janaway)	LAA 187A-15075	JL Adams, (Lower Cwmrtwrch, West Glamorgan)
G-WENA	40217A	Aérospatiale AS355F2 Ecureuil 2	5260	Aviation Support and Training GmbH, Zweibrücken, Germany
EI-EHF	4CA7DE	Aeroprakt A22 Foxbat	56	K Glynn (Loughrea, Co. Galway)
EI-EWG	4CAA1F	Airbus A330-223	927	Nightjar Ltd, (stored at Bordeaux-Mérignac, France)
EI-EWH	4CAA20	Airbus A320-223	891	Skua Ltd, (stored at Perpignan-Riversaltes, France)

NEW REGISTRATIONS

REG'N	MODE(S)	TYPE	C/N	OWNER
G-CIXE	407008	Morovan Zlin Z.326 Trener	928	JJB Leasor, Eaglescott, Devon
G-CJUA	40727C	Airbus Helicopters EC135T3	2009	Airbus Helicopters UK Ltd, Oxford, Oxfordshire
G-CJYT	4072DB	Airbus Helicopters EC130T2	8298	Airbus Helicopters UK Ltd, Oxford, Oxfordshire
G-CKEU	40735F	Airbus Helicopters EC135T3	2023	Airbus Helicopters UK Ltd, Oxford, Oxfordshire
G-CKIA	407378	Grob G.120TP-A	11129	Affinity Flying Training Services Ltd, RAF Barkston Heath, Lincolnshire
G-CKIB	407379	Grob G.120TP-A	11130	Affinity Flying Training Services Ltd, RAF Barkston Heath, Lincolnshire
G-CKIK	4073AE	Airbus Helicopters EC135T3	2025	Airbus Helicopters UK Ltd, Oxford, Oxfordshire
G-CKIX	4073B3	Aeropro EuroFOX 3K (assembled by Ascent Industries Ltd)	48716	RG Mulford, Rochester, Kent

G-CKLE	4073E6	AutoGyro MTOSport 2017 (assembled by Rotorsport UK Ltd)	RSUK/MT02/001	Rotorsport Sales and Service Ltd, Wolverhampton Halfpenny Green, Staffordshire
G-CKLK	4073E7	AutoGyro MTOSport 2017 (assembled by Rotorsport UK Ltd)	RSUK/MT02/002	Rotorsport Sales and Service Ltd, Wolverhampton Halfpenny Green, Staffordshire
G-CKLZ	407413	Boeing 787-9 Dreamliner	38774	Norwegian Air UK Ltd, London Gatwick, West Sussex
G-CKMK	40741D	AB Sportine LAK-17T	157	BN Searle, Saltby, Leicestershire
G-CKNP	407428	Avro RJ100	E3284	Tronosjet Maintenance Inc, Summerside, Canada
G-CKPC	40743C	Cameron Z-77	11170	AA Osman, (Wembley, Greater London)
G-CKPI	407447	Aérospatiale SA319B Alouette III	2076	S Atherton, Crab Tree Farm, Deighton, North Yorkshire
G-CKPR	407448	Cameron TR-65	12040	Cameron Balloons Ltd, (Bristol, City of Bristol)
G-CKPW	407440	AutoGyro Cavalon Pro (assembled by Rotorsport UK Ltd)	RSUK/CAVP/004	Rotorsport UK Ltd, Wolverhampton Halfpenny Green, Staffordshire
G-CKRE	407450	Atos-VR/La Mouette Samson	1511502	JS Prosser, (Poundbury, Dorset)
G-CKRL	407454	Europa Aviation Europa	PFA 247-13122	DM Cope, (Newbold Verdon, Leicestershire)
G-CLUP	407423	Schleicher ASH-25E		GG Dale and AK Laylee, Lasham, Hampshire
G-CSMD	40743E	Agusta A109A	7107	Jetcom SRL, (Rome, Italy)
G-DLUT	407405	Glasflugel 304ES (built by HPH Spol s.r.o.)	077-MS	AR Fish, Milfield, Northumberland
G-DPER	4071AD	Jonker JS-MD Single (built by M & D Flugzeugbau GmbH & Co. KG)	1C-MD120	MP Clark, Husbands Bosworth, Leicestershire
G-EAAB	407451	Pietenpol Air Camper	LAA 047-15170	PG Humphrey, (Aylesbury, Buckinghamshire)
G-ETPC	40738A	Grob G.120TP-A	11125	QinetiQ Ltd, MoD Boscombe Down, Wiltshire
G-ETPD	40738B	Grob G.120TP-A	11126	QinetiQ Ltd, MoD Boscombe Down, Wiltshire
G-GUAR	407419	Piper PA-28-161 Warrior II	28-7816576	BA Mills, Duxford, Cambridgeshire
G-HAMW	4073DC	Aeropro EuroFOX 3K (assembled by Ascent Industries Ltd)	52117	MD Hamwee, (London SW10)
G-HMEC	403C3B	Robinson R22 Beta	1767	Melimech Ltd, Brook Farm, Hulcote, Bedfordshire
G-HUME	407436	EAA AcroSport 2	PFA 072-10672	G Home, (Aldfield, North Yorkshire)
G-IACY	4073DF	ATR-72 212A	1448	Air Kilroe Ltd t/a Eastern Airways, Aberdeen International, Aberdeenshire
G-IDLE	4072F1	Airbus Helicopters AS350B3 Ecureuil	8377	Airbus Helicopters UK Ltd, Oxford, Oxfordshire

G-JHLE	407449	P & Aviation Quik GTR	8765	AD Carr, Finmere, Buckinghamshire
G-JMCH	406D69	Boeing 737-476	24439	Atlantic Airlines Ltd, Coventry, Warwickshire
G-KALI	401A36	Piper PA-28-140 Cherokee F	28-7325195	Akki Aviation Services Ltd, Turweston, Buckinghamshire
G-KITO	407425	Piper PA-24-260 Comanche	24-4386	A Costi, Firenze-Peretola, Italy
G-LHAB	407433	TAF Sling 2	LAA 399-15401	AP Beggin, (Oxford, Oxfordshire)
G-LINY	407444	Robinson R44 Raven II	12356	Helicentre Aviation Ltd, Leicester, Leicestershire
G-MGNI	4073F5	Magni M.16C Tandem Trainer (assembled by Magni Gyro Ltd)		Gyromania Ltd, Popham, Hampshire
G-MOUZ	40744A	Cameron O-26	12144	TJ Orchard and ME Banks (Aylesbury and Bristol)
G-OASK	407438	Aeropro EuroFOX 912(S) (built by A Stewart & N Watt)	LAA 376-15416	Aero Space Scientific Educational Trust, (Milnathort, Perth & Kinross)
G-OCGD	407421	Cameron O-26	12130	CG Dobson, (Goring, Oxfordshire)
G-OPOT	401384	Agusta A109S	22027	Sundorne Products (Llandiloos) Ltd, Welshpool, Powys
G-OPTZ	402B58	Pitts S-2A Special (built by Aerotek Inc)	2048	JL Dixon, Sherburn-in-Elmet, North Yorkshire
G-PCGC	4073B0	Allstar SZD-54-2 Perkoz	542.A.17.018W	JK Weeks, Gransden Lodge, Cambridgeshire
G-RCIE	404A8A	Piper J3C-65 Cub	7278	RP Marks, (Honiton, Devon)
G-RKAI	40614A	Diamond DA 40D Star TDi	D4.257	Airways Aviation Academy Ltd, Huesca-Pirineos, Spain
G-RMAA	407424	Airbus Helicopters BK117D-2	20166	Airbus Helicopters UK Ltd, Oxford, Oxfordshire
G-RVAR	40743B	Van's RV-8	LAA 303-15139	BA Ridgway, (Pontyclun, Mid Glamorgan)
G-SALD	407414	Bombardier Global 6000	9781	Esselco Aviation LLP, Farnborough, Hampshire
G-SAUL	40734C	Robin HR200/160	106	RA Smith, Earls Colne, Suffolk
G-SEAF	407375	Hawker Sea Fury FB.11	ES.3617	Patina Ltd, Duxford, Cambridgeshire
G-SHUI	407446	Cessna 680A Citation Latitude	680A0102	Air Charter Scotland Ltd, London Luton, Bedfordshire
G-ULRK	407442	Sequoia Falcon F.8L	PFA 100-15448	UKSSNM Lawson, (Jacobstowe, Devon)
G-UNAC	40745C	Piper PA-32R-301T Saratoga II TC	3257422	AC Campbell, (Horringer, Suffolk)
G-UWAS	404579	Scottish Aviation Bulldog Series 120/121	BH120/235	Mid America (UK) Ltd, Dornoch, Sutherland
G-WINZ	4073FC	Lindstrand LTL Series Special-Penguin	050	AM Holly, (Breadstone, Gloucestershire)



CitationJet CJ2, G-PEER, is now registered in the US as N6AE.

AirTeamImages.com/HAMFive

G-YROF	40742A	Magni M.22 Voyager	22-13-8184	Clocktower Fund Management Ltd, Fair Oaks, Surrey
G-ZACK	40745A	Cirrus SR20	1503	Modern Air (UK) Ltd, Fowlmere, Cambridgeshire
G-ZBJI	40731C	Boeing 787-9 Dreamliner	60626	British Airways PLC, London Heathrow, Middlesex
El-FPP	4CA8BB	Bombardier CRJ900LR	15435	Cityjet Designated Activity Company, Stockholm-Arlanda
El-FPR	4CACA0	Bombardier CRJ900LR	15436	Cityjet Designated Activity Company, Stockholm-Arlanda
El-FVX	4CA867	Boeing 737-800	42090	Norwegian Air International Ltd, Oslo Gardermoen, Norway
El-FZY	4CABB0	Boeing 737-800	44798	Ryanair Designated Activity Company (Dublin)
El-FZZ	4CABB1	Boeing 737-800	44796	Ryanair Designated Activity Company (Dublin)
El-GCO	4CAC9C	Airbus A320-214	5109	Avolon Aerospace (Ireland) AOE126 Ltd, (stored Bangalore-Bengaluru, India)
El-GCR	4CAC9E	Leonardo AW189	49021	Portrush Aviation Ltd, (Dublin)
El-GDA	4CABB2	Boeing 737-800	44797	Ryanair Designated Activity Company (Dublin)
El-GDB	4CABB3	Boeing 737-800	44799	Ryanair Designated Activity Company (Dublin)
El-GDC	4CABB4	Boeing 737-800	44800	Ryanair Designated Activity Company (Dublin)
El-GDD	4CABB5	Boeing 737-800	44802	Ryanair Designated Activity Company (Dublin)
El-GMO	Not allotted	Schleicher Ka.6E	4307	C Sinclair and W Kilroy, Gowran Grange, Co. Kildare
El-SLY	4CA932	ATR 72-202	341	ASL Airlines (Ireland) Ltd, Paris-Charles de Gaulle, France
M-ABLA	43EAF7	Boeing 737-86N	36813	GY Aviation Lease 1702 Co. Ltd, (stored Singapore-Seletar)
M-IRAS	43EAFB	Bombardier Global 6000	9766	STC Jet Ltd, TBA
M-SOBM	43EA24	Gulfstream G450	4303	Sobha Aviation Ltd, TBA
2-BASG	TBA	Boeing 737-73W(BBJ)	40117	Business Aviation Services Guernsey Ltd, Hong Kong International
2-CAUM	TBA	Bombardier DHC-8-Q402	4020	Aero Century Corp, (stored Maastricht, Netherlands)
2-CREW	TBA	Cessna 208B Grand Caravan	208B2148	ASL NV, Guernsey
2-ESKC	TBA	Boeing 737-3Y0(F)	23747	European Aviation Ltd, Bournemouth, Dorset
2-RLAT	TBA	Boeing 777-31HER	29063	SASOF III (B) Aviation Ireland DAC, (stored Teruel, Spain)
2-SALE	TBA	Diamond DA 62	62.069	Morson Group Ltd, Blackpool, Lancashire
2-SEVN	TBA	Boeing 727-281A	21474	TAG Aviation (Stansted) Ltd, Lasham, Hampshire
2-SEXY	43EB44	Agusta A109E Power	11010	Volare Aviation Ltd, Oxford, Oxfordshire

CANCELLATIONS

REG'N	TYPE	C/N	REASON
G-ADXT	de Havilland DH.82A Tiger Moth	3436	Cancelled as Destroyed (crashed near Compton Abbas, Dorset 26.07.17)
G-ATMT	Piper PA-30-160 Twin Comanche	30-439	Cancelled as Destroyed (crashed at Aston Rowant Nature Reserve, Chiltern Hills, Oxfordshire 15.01.17)
G-BASL	Piper PA-28-140 Cherokee F		28-7325195 Re-registered as G-KALI
G-BEVG	Piper PA-34-200T Seneca II	34-7570060	To Germany
G-BHWH	Weedhopper JC-24A	0074	Cancelled as Permanently WFU

PREVIOUS IDENTITIES

REG'N	P.I.	REG'N	P.I.
G-ANJI	ex C-GIZA	G-RCIE	ex G-CCOX
G-BJXA	ex G-GFAA	G-RKAI	ex JY-DDD
G-BRZF	ex G-IDUP	G-RMAA	ex D-HCBS
G-BVYS	ex HB-IXT	G-SALD	ex C-FRYZ
G-BXIW	ex LY-OEN	G-SAUL	ex SE-KNA
G-CIXE	ex F-BPNM	G-SEAF	ex VH-SFY
G-CJUA	ex D-HECG	G-SHUI	ex N52144
G-CKEU	ex D-HCBC	G-UNAC	ex OK-VSK
G-CKIK	ex D-HECJ	G-UWAS	ex G-CBAB
G-CKLK	ex D-MJGA	G-WENA	ex (D-H...)
G-CKMK	ex D-KYSG	G-ZACK	ex TC-CHK
G-CKNP	ex HB-IXO	El-EHF	ex I-9266
G-CKPI	ex N8UH	El-EWG	ex 5N-JID
G-CLUP	ex OE-5525	El-EWH	ex 5N-JIC
G-CSMD	ex I-CVMD	El-GCO	ex PR-MYS
G-ETPC	ex D-ETQI	El-GCR	ex I-LCIB
G-ETPD	ex D-ETIQ	El-GMO	ex G-CJHD
G-GUAR	ex F-GUAR	El-SLY	ex HB-AFV
G-HMEC	ex G-BWTH	M-ABLA	ex B-5436
G-IACY	ex F-WWEU	M-IRAS	ex C-FNXK
G-IDLE	ex G-CJZA	M-SOBM	ex M-SOBR
G-JMCH	ex N475VX	2-BASG	ex VP-BOP
G-KALI	ex G-BASL	2-CAUM	ex C9-AUM
G-KITO	ex I-KITO	2-CREW	ex 00-PZG
G-LINY	ex HB-ZWO	2-ESKC	ex XA-AJA
G-OPOT	ex G-EMHD	2-RLAT	ex A6-EMN
G-OPTZ	ex G-SKNT	2-SEVN	ex N724YS
G-PCGC	ex SP-3970	2-SEXY	ex ZS-RJD

G-BNHG	Piper PA-38-112 Tomahawk	38-82A0030	Cancelled as Permanently WU (details unknown, CoFA current to 26.06.18)
G-BUOI	Piper PA-20-135 (modified)	20-571	Cancelled by CAA (crashed on landing at Auxerre-Branches, France 14.07.14)
G-BUOK	Rans S.6-116 Coyote II	PFA 204A-12317	Cancelled as Destroyed (Stalled on take-off at Bagby, North Yorkshire 20.06.17)
G-BUJL	Fisher Super Koala	PFA 226-11399	To France
G-BWTH	Robinson R22 Beta	1737	Re-registered as G-HMEC
G-BYPD	Cameron A-105	4680	Cancelled as Permanently WFU (CoFA expired 16.02.12)
G-BYPT	Rans S.6-ES Coyote II	PFA 204-13508	To New Zealand
G-CBAB	Scottish Aviation Bulldog 120/121	BH120/235	Re-registered as G-UWAS
G-CCOS	Cameron Z-350	10513	Cancelled as Permanently WFU (CoFA expired 19.03.15)
G-CCOX	Piper J3C-65 Cub	7278	Re-registered as G-RCIE
G-CCXR	Mainair Blade	1367-0604-7-W1162	Cancelled as Destroyed (stalled and crash in a river near Pembroke Dock, Pembrokeshire 09.03.17)
G-CDLB	Cameron Z-120	10672	To Mexico
G-CDZD	Van's RV-6A	PFA 320-13966	To Australia
G-CELR	Boeing 737-330	23523	Cancelled as Permanently WFU (to Cotswold Airport 16.11.16 for parting out. Fuselage roaded to Glasgow Prestwick 07.09.17 for use as a cabin trainer by Ryanair)
G-CEYD	Cameron N-31	3558	Cancelled by CAA (CoFA expired 17.07.08)
G-CGRO	Robin DR400/140B Major 80	2272	To France
G-CGTG	Best Off Skyranger 912S(1)	BMAA/HB/512	Cancelled as Permanently WFU (stolen from airstrip at Whittington, Staffordshire 12.15)
G-CHSZ	Rolladen-Schneider LS8-A	8030	To France
G-CIES	Rand KR-2	PFA 129-11767	Cancelled as Permanently WFU (Permit to Fly expired 14.07.17)
G-CIZK	Magni M.16C Tandem Trainer	16-16-9534	Cancelled as Destroyed (crashed on landing at Popham 17.06.17)
G-CJJU	Rolladen-Schneider LS8-A	8200	To Germany
G-CJUA	Airbus Helicopters EC135T3	2009	To Ministry of Defence as Juno HT.1 ZM510
G-CJXU	Airbus Helicopters EC135T3	2012	To Ministry of Defence as Juno HT.1 ZM513
G-CJYB	Grob G.120TP-A	11111	To Ministry of Defence as Prefect T.1 ZM302
G-CJZA	Airbus Helicopters AS350B3 Ecureuil	8377	Re-registered as G-IDLE
G-CKCG	MBB Bo105P	6036	To Denmark
G-CKCO	Grob G.120TP-A	11127	To Ministry of Defence as Prefect T.1 ZM309
G-CKIA	Grob G.120TP-A	11129	To Ministry of Defence as Prefect T.1 ZM311
G-CKIB	Grob G.120TP-A	11130	To Ministry of Defence as Prefect T.1 ZM302
G-CJYB	Grob G.120TP-A	11111	To Ministry of Defence as Prefect T.1 ZM312
G-CKIR	Avro RJ100	E3361	Cancelled as Permanently WFU (to Norwich, Norfolk for storage 17.05.17)
G-DGCL	DG Flugzeugbau DG-800B	8-185B109	To Germany
G-EDBD	PZL-Bielsko SZD-30 Pirat	S-02.02	Cancelled by CAA (CoFA expired 23.04.14)
G-EMHD	Agusta A109E Power	22027	Re-registered as G-OPOT
G-ETPC	Grob G.120TP-A	11125	To Germany as D-ETIQ (but restored again six days later)
G-ETPD	Grob G.120TP-A	11126	To Germany as D-ETIQ (but restored again six days later)
G-GERN	AutoGyro Cavalon	RSUK/CVLN/020	Cancelled as Destroyed (crashed on mud banks at Stoke Creek, Kent 18.06.17)
G-GFAA	Slingsby T.67A	1994	Re-registered as G-BJXA
G-HKCN	Airbus Helicopters AS350B3 Ecureuil	8219	Cancelled as Destroyed (crashed into Sandviken Bay, near Bergen, Norway while trying to land on MY <i>Bacarella</i> 19.05.17)
G-HOCK	Piper PA-28-180 Cherokee D	28-4395	Cancelled as Destroyed (crashed on landing at Sandown, Isle of Wight 30.06.17)
G-IDUP	Enstrom 280C	1163	Re-registered as G-BRZF
G-IMED	Cessna 550 Citation II	550-0085	To France
G-ISON	Airbike UK Lite	001	To Germany
G-JECE	Bombardier Dash 8-Q402	4094	To Canada as C-FXIC
G-MATH	Airbus Helicopters AS350B3 Ecureuil	8274	Cancelled as Destroyed (rolled over on landing at Wycombe Air Park, Buckinghamshire 05.05.17)



Former Titan Airways Boeing 737-300QC, G-ZAPW has been sold and assigned the registration N421AU. AirTeamImages.com/Dave Sturges

G-MBTW	Aerodyne Vector 600	1188	Cancelled by CAA
G-MMZV	Mainair Gemini Flash	313-585-3-W52	Cancelled by CAA (Permit to Fly expires 05.12.17)
G-MTXL	Noble Hardman Snowbird Mk.IV	SB-006	To Republic of Ireland
G-MTZR	Solar Wings Pegasus XL-Q	SW-WQ-0060	To Latvia
G-MVHG	Mainair Gemini Flash IIA	694-988-6-W464	Cancelled by CAA (Permit to Fly expired 20.06.10)
G-MYIX	Quad City Challenger II	PFA 177-12260	Cancelled as Permanently WFU (crashed near Louth, Lincolnshire 02.05.14)
G-MYXF	Air Creation Fun 18S GTBis	94/005	Cancelled by CAA (Permit to Fly expired 17.07.14)
G-MZNZ	Letov LK-2M Sluka	PFA 263-13274	Cancelled as Destroyed (crashed after hitting power lines at College Farm, Oakley, Bedfordshire and destroyed by fire)
G-OVIA	Lindstrand LBL 105A	1002	To Australia
G-PEER	Cessna 525A CitationJet CJ2	525A0360	To USA as N6AE
G-PHNM	Embraer Phenom 100	50000165	To France
G-PSHR	Agusta Bell AB206B JetRanger III	8690	To Guernsey
G-RAAA	Bombardier Global Express XRS	9423	To Malta as 9H-JSY
G-ROYN	Robinson R44 Raven I	1646	To Sweden as SE-JTL
G-SIMO	Robinson R44 Raven I	1858	To San Marino
G-SKNT	Pitts S-2A Special	2048	Re-registered as G-OPTZ
G-SLII	Cameron O-90	2388	To Hungary
G-SUMZ	Robinson R44 Raven II	10490	To France
G-UTZI	Robinson R44 Raven II	10590	Cancelled by CAA (CoFA expired 02.03.15, was based in Spain)
G-WACI	Beech 76 Duchess	ME-289	Cancelled as Permanently WFU (CoFA expired 22.11.12, sold in Republic of Ireland for spares)
G-WCKD	Eurocopter EC130B4	4746	To Switzerland
G-WPAS	MD Helicopter MD902 Explorer	900-00053	To Luxembourg
G-XYAK	Yakovlev Yak-52	899413	To USA
G-YAKA	Yakovlev Yak-50	822303	To USA
G-YAKB	Yakovlev Yak-52	9211517	Cancelled as Permanently WFU (crashed near Dinton, Wiltshire 08.07.16)
G-ZAPW	Boeing 737-3L9	24219	To USA as N421AU
El-DKI	Robinson R22 Beta II	3882	To Australia
El-FJF	Boeing 737-86N	36814	To South Korea as HL7213
El-GCO	Airbus A320-214	5109	To India as VT-IXC
El-SLA	ATR-42-300	149	Cancelled at Removed from Service (flown to Cotswold Airport, Gloucestershire 16.08.17 for parting out)
El-UNX	Boeing 777-222	30213	To USA as N793ST
M-ABJN	Bombardier Challenger 605	5767	To USA as N605JG
M-MNCC	Dassault Falcon 7X	156	To Switzerland as HB-JFS
M-RIDE	Bombardier Global 5000	9190	To USA as N117LB
M-SAAJ	Gulfstream G550	5301	To USA as N260DL
M-SOBR	Gulfstream G450	4303	Re-registered as M-SABM
2-ESKC	Boeing 737-3Y0(F)	23747	To USA as N331CK
2-RLAO	ATR 42-500	1002	To Colombia as HK-5236-X
2-RLAP	ATR 42-500	1005	To Colombia as HK-5237-X
2-TPAJ	ATR 72-212A	749	To Nepal as 9N-AMM
2-TYAM	Embraer 190	190000403	Cancelled as parted out (to MoD St. Athan, Glamorgan 27.03.17)
2-TYAN	Embraer 190	190000367	Cancelled as parted out, to Goodyear (Phoenix) Litchfield Municipal, Arizona, 26.04.17

Key: NB – Nominal Base

A place name in brackets relates to the owner's address as where the aircraft is based is unknown.



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AIRPORT MOVEMENTS

A round-up of notable aircraft visiting UK airports.



ABERDEEN

1/9 B-8292 Gulfstream G550; HB-IYI Saab 2000 Darwin Airlines & PH-FCI Jetstream 32 AIS Airlines both op for Eastern Airways; G-MRLI S-92A Bristow Helicopters on delivery. **5/9** LN-AGR Falcon 7X. **6/9** PH-ACI Cessna T.303; F-HTTO Global 5000. **10/9** 0001 Gulfstream G550 1 BLT, Polish AF; HB-JOB Falcon 7X. **11/9** HB-IZJ Saab 2000 Darwin Airlines op for Eastern Airways. **17/9** F-HEND Citation 510 Mustang; D-AGRA CRJ200LR ProAir op for BMI Regional. **19/9** OO-PCJ PC-12. **21/9** OE-FXM CitationJet 525A CJ2; EI-JSK Gulfstream G650. **22/9** OY-BPO CRJ200LR Backbone Aviation; OY-SWO Falcon 2000S. **23/9** OY-HMV EC175B Noordzee Helikopters Vlaanderen dep for Esbjerg, ex OO-NSK. **24/9** C-GSTG Challenger 604. **27/9** D-AFAB Challenger 604. **28/9** OY-HWP AW139. **30/9** OK-PPP Beech 400XT.

BIRMINGHAM

1/9 LN-LNB 787-8 Norwegian, to MAEL; T-729 Beech 1900D LTDB, Swiss AF. **2/9** B-2723 787-8 Hainan Airlines, Manchester diversion; N888TY BBJ1. **4/9** OE-LYY A319-132 Eurowings f/v; UR-CEZ & UR-CKL An-12BPs Cavok Air; UR-CZZ An-12BP Ukraine Air Alliance; D-CASH Phenom 300; OY-RIB Avanti also 19th. **7/9** D-AIAD A321-211(SL) Thomas Cook Airlines f/v; D-AINF A320-271N Lufthansa f/v; UR-CGV An-12BP Ukraine Air Alliance; F-HSHB Citation 510 Mustang; D-CHRA CitationJet 525B CJ3; D-CCCA Learjet 35A. **8/9** EI-FVU 737-8JP Norwegian f/v; SE-DOY A320-251N SAS f/v. **10/9** HZ-AB3 727-2U5; **4X-CLL Galaxy**; YU-SPB Citation 560XLS. **11/9** OE-GKW Gulfstream G150. **12/9** F-HMBY Global 6000. **13/9** UR-CNT An-12BK Ukraine Air Alliance; D-IDBA Premier1A; HB-JSG Challenger 605. **14/9** F-HOIE Avanti; OE-ITH Challenger 604. **15/9** EW-259TG An-26B Genex.

Gulfstream G550, N528AP, of the Arrow Plane company was captured landing at London Luton Airport on October 5 wearing an unusual colour scheme. Paul K Ferry/ Apron Media

17/9 OY-JTS 737-7H2 Jetttime. **18/9** EI-FPP CRJ900LR SAS f/v. **19/9** EI-FPM CRJ900LR SAS f/v; D-AUTO Gulfstream G550; D-CMMP Phenom 300; PH-HGT Citation 680 Sovereign+. **20/9** EI-FPJ CRJ900LR SAS f/v. **21/9** C-GWHF Global XRS; D-ITIM HondaJet. **22/9** A6-EUY A380-842 Emirates f/v; EI-FPF CRJ900LR SAS f/v; UR-CGW An-12BP Ukraine Air Alliance; D-IPCG Cessna 425; D-FSID TBM 700C1. **23/9** B-8206 Falcon 7X. **24/9** **C-FVDC Dash 8-Q402NG ANA Wings on delivery**; D-CITA Learjet 60; LX-MBE Falcon 2000. **25/9** LZ-ABJ An-26B Rose Air; F-HDPY & F-HGIO Citation 510 Mustangs. **26/9** D-AINH A320-271N Lufthansa f/v; D-AIWB A320-214(SL) Lufthansa; YL-RAI ATR 72-200/F RAF-Avia f/v; OE-GDF Phenom 300 f/v; PH-JFS PC-12. **27/9** D-CAWB Citation 680 Sovereign; D-CGBR Learjet 55; D-ISHF PA-31T1 Cheyenne 1; HB-FVD PC-12. **29/7** S5-ICR Citation 560XL; SP-RDW Premier 1A. **30/9** G-VNEW 787-9 Virgin Atlantic f/v, to MAEL; VT-ANZ 787-8 Air India f/v; OO-AMR CitationJet 525A CJ2+.

BLACKPOOL

3/7 D-CDOC Learjet 45; F-HATG CitationJet 525C CJ4 also 19th; YU-SPB Citation 560XLS. **5/7** OO-ACO Citation 510 Mustang also 7th. **8/7** D-CEXP Learjet 35A. **9/7** HB-VDW Learjet 45. **12/7** HB-KHK Columbia LC41-550FG. **13/7** F-HETM EC120. **16/7** D-ELIC Cessna TR.182RG. **17/7** C-GRBA Challenger 300; D-CFIV Learjet 35A; EC-IOD P-68C dep 24th. **23/7** OK-UNI Citation 680 Sovereign. **25/7** LN-OBX AS332C1 Airlift AS n/s. **27/7** OK-UGJ Citation 680 Sovereign.

BRISTOL INTERNATIONAL

3/8 2-GOOD Cirrus SR-22. **4/8** OK-PBT CitationJet 525A CJ2. **5/8** N542AP Falcon 2000EX also 9th; 2-JSEG Eclipse EA.500. **6/9** F-HBTV Citation 525 M2 n/s; HB-JRA Challenger 604. **8/8** F-HOIE Avanti. **9/8** EI-LEO Citation 750 X; F-HBIR Citation 510 Mustang dep 11th. **13/8** D-CFAZ Learjet 55. **23/5** EC-MLA Falcon 2000S dep 25th. **25/8** D-CEIS Citation 680 Sovereign also 27th.

CAMBRIDGE

4/9 C-GAPT Citation 750 X; EI-CZA ATEC 2000; EI-FBY BRM Land Africa; EI-WIG Skyranger; I-C513 ICP Savannah; OK-EAS Beech 400A. **8/9** M-DSKY TBM 830. **18/9** D-CEXP Learjet 35A. **21/9** 9H-VFB Challenger 605. **22/9** I-NHCO Falcon 2000LX. **22/9** D-CGMR Citation 560XLS. **26/9** OE-FZB & OE-FIT Citation 510 Mustangs. **29/9** EC-LMR BAe 146-300QT ASL Airlines.

DURHAM TEES VALLEY

1/8 T-785 Falcon 900EX LTDB, Swiss AF. **6/8** N288Z Gulfstream G650. **6/8** VP-BZE Falcon 7X. **11/8** 2-BOYS Commander 114B n/s also 18th; PH-RLG Citation 680 Sovereign n/s. **13/8** N810TD Legacy dep 15th. **14/8** F-HERE Citation 510 Mustang n/s also 20th-22nd. **15/8** EC-JDA PA-34-220T o/s also 28th o/s; D-IROL Do.228-100 Businesswings. **16/8** 2-LAND Commander 114B dep 19th. **17/8** D-CFHZ Phenom 300 dep 20th. **20/8** 2-GOLF CitationJet 525A CJ2+; OO-PCK PC-12 dep 23rd. **27/8** ZK551 & ZK552 Chinook HC2s 7 Sqn, RAF; ZJ198 & ZJ210 Apache AH1s 3/4 Regts, AAC dep 29th. **29/8** 2-BLUE Challenger 601-3A. **30/8** EC-LYL Citation 560XLS dep 1/9.

EAST MIDLANDS

3/9 D-AALI 777-FZN Aerologic f/v. **6/9** SP-ATT Beech 400XP; C-GEJD Learjet 45. **7/9** VQ-BRH 747-8HVF AirBridgeCargo & 9V-SFO 747-412F Singapore Airlines Cargo, D-CFHZ Phenom 300. **8/9** 9V-SFK 747-412F Singapore Airlines Cargo, RA-82074 An-124-100M Volga-Dnepr Airlines. **9/9** ZZ334 Voyager KC3 10/101 Sqn, RAF. **10/9** VP-BBP 747-8HVF AirBridgeCargo. **14/9** D-ISAR Premier 1A. **15/9** LX-LAR Learjet 45. **16/9** 2-PLAY TBM 700. **18/9** UR-CGV An-12BP Ukraine Air Alliance. **19/9** A6-DCA A330-243F Etihad Cargo. **21/9** G-CLBA 747-428FER CargoLogicAir, hurricane relief flight. **22/9** CS-TQZ A340-313X HiFly op for Thomas Cook; D-CITA Learjet 60. **23/9** OM-OPR

SprintAir ATR 72-200, SP-SPE, arriving at Doncaster Sheffield Airport on October 15. Clive Featherstone



CitationJet 525 CJ1. 25/9 9H-FGV Phenom 100.
27/9 CS-TFR Learjet 45; D-IZZY Avanti; OH-WII
Challenger 604. 28/9 2-JSEG Eclipse EA.500.

EXETER

3/9 9H-BCP Learjet 45. 4/9 D-IBIS Cessna T.303
also 9th. 6/9 65-DAH/F-JBWO Pipistrel Alpha
Trainer. 8/9 OY-SKK Falcon 8X. 16/9 9H-BOM
Challenger 605. 23/9 OO-PCK PC-12; EI-FGX 737-
3Q8 Mistral Air also 30th. 24/9 SE-RMJ CitationJet
525B CJ3. 27/9 OE-GBE Astra SPX. 29/9 D-AHOS
Legacy 650. 30/9 OO-CJP Cessna 414A.

Flybe Aviation Services

15/9 EC-LCQ E195LR Air Europa dep 24th. 25/9
EC-KXD E195LR Air Europa dep 2/10.

GLASGOW

5/9 OK-OKS PA-42-1000 Cheyenne 400; C-GJCB
Global 5000. 6/9 HB-GGP Beech 58P; OY-EDP
Citation 650 III; 85 Xingu 28F, French Navy. 8/9
D-CFTG Learjet 35A. 10/9 OY-KFD CRJ900
SAS Aberdeen diversion. 11/9 LZ-ASO Avanti;
F-HAVI 757-26D Open Skies; D-AGWE A319-132
Germanwings; 4X-CLL Galaxy. 12/9 F-HBZA
Citation 550 II; D-AXTM Global XRS; D-ALEX
A319-115(CJ). 13/9 PH-TCN Avanti. 16/9 TF-GPA
A321-211(SL) WOW Air; F-HBXJ E170STD Hop!
19/9 D-CMMP Phenom 300; 2-DARE PC-12; OE-
GKW Gulfstream G100; SE-RHD Citation 560XLS+.
21/9 F-HTLV Cessna 182J; F-HPGA Beech 350.
22/9 D-AZEM Falcon 900EX; D-BADC Do.328JET.
23/9 N457XJ Saab 340A ex 5Y-FSI; 168071/BH KC-
130J VMGR-252, USMC. 24/9 N3533Q Metro 23.
26/9 N930ZB TBM 930 c/n 1198 on delivery. 27/9
C-FRJJ Astra SPX; OE-IVA A320-214(SL) EasyJet
ex G-EZPA. 28/9 ZS-NMH CRJ200ER South
African Express Airways; F-HATG CitationJet 525C
CJ4. 29/9 ZZ334 Voyager KC3 10/101 Sqns, RAF;
50+76 Transall LTG63, German AF; D-IKSI Avanti.
30/9 VT-JSK Global 5000.

GUERNSEY

1/7 HB-JVE Fokker 100 Helvetic op for Avanti Air;
HB-FEW PC-12. 2/7 HB-IAU Falcon 2000EX. 3/7
2-LIFE Eclipse EA.500. 4/7 HB-FWT PC-12; HB-
TLM Cessna 182T dep, arrived in June as N420CV;
D-EODC Cessna 172S. 5/7 D-FNAH PC-12;
PH-MIK Cessna T.182T. 7/7 LX-LGN Dash 8-Q402
Luxair; HB-KLA Robin DR.400/140B. 8/7 F-GHPM
Mooney M.20J. 9/7 LX-LGM Dash 8-Q402 Luxair.
10/7 9H-OKI Global Express dep 12th as OE-IRB;
OY-EDP Citation 650 III. 12/7 VP-CSP BAe.125-
800. 13/7 PH-GVB Cessna 172S; F-GINM Robin
DR.400/140B. 14/7 LX-PMA Challenger 300 dep
26th as N675LC; 2-RIOH Navion Rangemaster.
15/7 F-GORH Robin DR.400/140B; F-BVTF PA-28-
181. 17/7 HB-IUV Gulfstream G200; HB-CIR Cessna
182Q. 18/7 OK-XLS Citation 560XLS+; D-GOMH
Diamond DA-42. 19/7 P4-MVP Gulfstream G450
dep 31st as M-LFBB. 20/7 OK-STL Cirrus SR-22.
21/7 9H-FAM Phenom 100; D-ELKC & D-ELKX
PA-28-181s. 22/7 F-HBTV Citation 525 M2. 23/7
LX-FDA Falcon 7X. 25/7 EC-KLY & EC-KLZ Cirrus
SR-22s. 31/7 2-LIVE PC-12 first flight as such,
arrived as SP-NAP.

INVERNESS

5/7 OY-SKK Falcon 8X; SP-MRB Saab 340A Skytaxi;
PH-CGC Do.228-212 Netherlands Coast Guard n/s;

Citation XLS S5-ICR visiting Exeter Airport on October 15. Ian Simpson



C-GHWW Challenger 605. 7/7 3A-MGA Falcon 7X
dep 9th. CS-TFR Learjet 45. 8/7 S5-SAD Global
6000; D-CHRD Citation 680 Sovereign. 9/7 S5-JVA
Gulfstream G450. 12/7 SE-RMR Citation 560XLS.
14/7 OE-GLS Citation 650 VII; OY-MLS P-68B dep
23rd. 15/7 D-CXNL Hawker 800XP. 16/7 OO-FPE
CitationJet 525B CJ3. 18/7 D-ISAV Cessna 402B.
19/7 F-PIMS DynAero MCR-4S; DU-142 AW139
Dubai Air Wing; A6-FZZ 737-8KN Dubai Air Wing.
22/7 D-CUTE Beech 350; D-IFTC Beech 200.
24/7 HB-FVM PC-12. 26/7 F-GPYB Beech 1900C
Atlantique Air Assistance; OE-GMG Citation 650 VII.
30/7 D-IPIT Diamond DA-62. 31/7 107/ABP TBM
700A EAAT, French Army.

LEEDS BRADFORD

1/7 D-AHOS Legacy 650. 3/7 OM-FTS CitationJet
525A CJ2. 5/7 LX-LOE Hawker 400. 6/7 OK-RAH
Beech 400XP. 7/7 EC-MFS 737-4Y0 AlbaStar. 7/7
OY-JSW CitationJet 525A CJ2+. 12/7 EI-PRO
AS365N2. 13/7 EI-FWA Su-95 CityJet type f/v; EC-
LAV 737-408 AlbaStar. 17/7 9H-WFC Legacy 600.
18/7 9H-ILI Challenger 850. 20/7 N606TJ Falcon 7X.
22/7 N721EE Legacy 500. 23/7 9H-MAC 737-548
Maleth Aero; 9H-ILY Challenger 850. 26/7 D-AOLG
Fokker 100 OLT; SE-RMC Challenger 300. 28/12
F-HOLI PC-12; 9H-YES 737-5Q8 Air X Charter. 31/7
OK-HWK Hawker 900XP; PH-LPH EC120B.

LONDON GATWICK

1/9 G-CKNA 787-9 Norwegian f/v; TC-JIN A330-203
Turkish Airlines f/v. 2/9 TC-JIM A330-203 Turkish
Airlines f/v. 3/9 TC-JOM A330-302 Turkish Airlines
f/v. 4/9 EC-MQP 737-800 Air Europa f/v. 5/9 TC-JNZ
A330-343E Turkish Airlines f/v. 6/9 A6-EUJ A380-
861 Emirates f/v. 7/9 D-ABUF 767-330ER Condor
Flug op for Thomas Cook. 11/9 HZ-HR5 737-8AN
f/v. 12/9 TC-JOD A330-343E Turkish Airlines f/v;
T7-PRM Gulfstream G200 f/v; 4X-CLL Galaxy. 13/9
EI-FVX 737-800 Norwegian f/v. 14/9 VP-BAE A321-
211 Aeroflot f/v. 16/9 EI-FYE 737-8MAX Norwegian
f/v. 17/9 G-CKKL 787-9 Norwegian f/v; OK-TSR
737-82R Travel Service f/v. 19/9 EI-GAW 737-8Z0



Omni Air Boeing 777-200ER, N819AX, at Manchester Airport on October 9. It was taking home passengers who had been due to fly with Monarch Airlines. Martyn Cartledge/ASP Photography

Blue Panorama op for Norwegian. 23/9 D-IAWG
Cessna 425 f/v; F-HMOD Falcon 7X f/v; 25/9 B-LRS
A350-941 Cathay Pacific f/v; CS-TTW E195AR TAP
Air Portugal f/v; D-COBI Citation 560XLS; HA-JEP
Citation 650 III f/v; OY-JJJ Hawker 4000 f/v; 95-
00123 UC-35A 1-214th Avn, US Army f/v.

LONDON HEATHROW

23/9 HS-THD A350-941 Thai Airways International
f/v; OH-LWK A350-941 Finnair f/v. 26/9 EP-IJB
A330-243 Iran Air f/v. 27/9 N26970 787-9 United
Airlines f/v; OH-LWL A350-941 Finnair f/v. 28/9 HS-
THE A350-941 Thai Airways f/v. 29/9 B-8386 A330-
343 Air China f/v; G-ZBJI 787-8 British Airways on
delivery. 30/9 HS-THG A350-941 Thai Airways f/v.

1/10 HI985 Citation 680 Sovereign f/v. 4/10
N626JE Gulfstream V f/v. 6/10 F-HRBC 787-9 Air
France f/v; HB-JCE CS300 Swiss f/v; RP-C7772
777-3F6ER Philippine Airlines f/v. 8/10 D-CUUU
Citation 560XLS+ f/v; EC-JHL 737-85P Air Europa
op for Germanwings f/v; EC-MNR CRJ1000 Croatia
Airlines f/v; PK-GII 777-3U3ER Garuda f/v. 11/10
A7-BEL 777-300ER Qatar Airways f/v. 12/10 SE-
ROE A320-251NSL SAS f/v. 15/10 4X-EDB 787-9
EI AI f/v; RP-C7779 777-300ER Philippine Airlines
f/v. 16/10 A7-ALS A350-941 Qatar Airways f/v; YR-
BML 737-82R Blue Air op for LOT f/v. 21/10 A7-ALQ
A350-941 Qatar Airways f/v; F-HMAS Falcon 7X f/v.

LONDON LUTON

1/9 CS-DVY Legacy 600. 2/9 SE-RLU Citation 560
Ultra; OK-AST Citation 560XL; OE-GIQ Learjet
45. 3/9 OM-TSG 737-82R Smartwings; OM-
GTF 737-86J Go2Sky; CS-IHP Falcon 2000. 4/9
HZ-SKY4 A319-115CJ. 5/9 I-DBLR Challenger
650; C-FIGI Falcon 900EX. 9/9 OE-FIT Citation
510 Mustang. 10/9 N480CH BBJ1. 11/9 TT-DIT
Falcon 900; N188W Gulfstream G650. 12/9
HA-YFK Beech 400. 14/9 TC-KNK Falcon 2000S;
N724MF Global 5000. 16/9 N946BA Gulfstream
G200. 17/9 YU-TPC Citation 500 1; N721EE Legacy
500; N871FR Gulfstream G650. 18/9 A6-MAF



Exeter Airport hosted Falcon 900EX, C-GWFM, of Skyservice Business Aviation on October 22. Ian Simpson

Gulfstream G650ER; **ES-KLT Avanti**. 20/9 N200ES Gulfstream G650ER. 22/9 N912JC Legacy 650. **25/9 F-HITO Global 5000**. 27/9 LX-JET Legacy 450. **28/9 ZS-DDT Hawker 4000**. 29/9 N744C Falcon 8X; N501PG Falcon 7X. 30/9 HA-LXV A321-231(SL) Wizz Air; OE-GOL Citation 560XLS.

MANCHESTER

1/9 PH-STB Falcon 900C f/v. 2/9 CS-TKT 767-36NER Euroatlantic f/v, op for Titan. 4/9 TC-JOB A330-303 Turkish Airlines f/v; C-GUBC A330-243 Air Transat f/v; TC-CPZ 737-8H6 Pegasus Airlines f/v; D-AGBH Falcon 7X f/v; 9H-INV Challenger 604 f/v; CS-DVZ Citation 501 1/SP f/v; CS-DTT Falcon 7X f/v. 5/9 OO-FPF Citation 525B f/v; D-CXNL Hawker 800XP f/v. 6/9 D-AINF A320-271N(SL) Lufthansa f/v; F-HBOD Phenom 100 f/v. 8/9 LZ-EAA A320-231 Electra Airways f/v, op for Maleth Aero; OE-IGG Global Express f/v. 9/9 A6-EUQ T7-SKA Global Express f/v. 10/9 D-ABHN A320-214 Eurowings f/v; EC-LXV 737-85P Air Europa f/v. 11/9 OY-JTT 737-73S Jettime f/v. 12/9 HB-JOG A319-111 Germania Flug f/v; **1301 A330-243MRTT UAE Air Force, n/s**; F-HMBY Global 6000 f/v; D-CHIP CitationJet 525B CJ3 f/v. 13/9 SP-KPU Saab 340A/F SprintAir f/v. 15/9 EI-FVX 737-800 Norwegian f/v. 16/9 CN-RNU 737-8B6 Royal Air Maroc f/v; C-GJZJ CRJ200 Voyageur Airways f/v. **19/9 EI-FVO 737-800 Norwegian** f/v; SE-ROB A320-251N SAS f/v; D-AINH A320-271N Lufthansa f/v; D-CMMP Phenom 300 f/v. 21/9 D-ABHO A320-214 Air Berlin f/v, op for Eurowings; N280GL Gulfstream G280 type f/v. 22/9 9H-ILI Challenger 850 f/v. 23/9 D-AING A320-271N Lufthansa f/v. 25/9 UR-GAH 737-32Q Ukraine International Airlines; VQ-BNS A330-343X Aeroflot also 28th; CS-TQW A330-223 Hi Fly for painting at Air Livery. 26/9 UR-GBA 737-36N Ukraine International Airlines f/v, C-FFPH 737-81D Sunwing / TUI f/v, Norwich diversion. 27/9 A6-BLE 787-9 Etihad Airways f/v. 28/9 A6-BLP 787-9 Etihad Airways f/v; EC-JDY Beech 1900C1 Serair f/v; N666ML BBJ1 f/v.

NORWICH

2/7 ZU-IHF Van's RV-10; EC-MFS 737-4Y0 AlbaStar. **8/7 G-JMCM 737-3Y0/F Atlantic Airlines** to KLM Maintenance dep 12th. 9/7 S-134 & S-191 Super Lynx Mk.90B Esk 723, Royal Danish AF. 10/7 SE-DSY RJ100 Braathens Regional Airline to KLM Maintenance. 12/7 G-JMCV 737-4K5 Atlantic

Airlines to KLM Maintenance dep 1/8; SE-MFF Saab 2000 Braathens Regional Airlines to Air Livery, dep 14th. 13/7 TF-SIF Dash 8-314 Icelandic CG also 14th. 15/7 PH-JTJ Citation 680 Sovereign; F-HFKF E145LR SIAvia. 18/7 D-CKJE Phenom 300; TZ-PRM BBJ1 to KLM Maintenance, dep 1/8. **19/7 F-HAHA Citation 510 Mustang**. 20/7 F-HEND Citation 510 Mustang. 21/7 **5N-BTW AW139 Bristow Helicopters Nigeria**; C-FPSH Do.228-202 Alta Flights. 22/7 D-BONN Falcon 2000EX EASy also 29th. 24/7 D-CHEC Citation 680 Sovereign. **26/7 SE-DSX RJ100 Braathens Regional Airlines** to KLM Maintenance, dep 10/8. 29/7 G-JMCY 737-4Q8(SF) Atlantic Airlines to KLM Maintenance dep 7/8. 30/7 F-HBIR Citation 510 Mustang. 31/7 D-CAMB Learjet 31A.

PRESTWICK

1/8 LZ-ABJ An-26B Rose Air; EW-483TI An-12BK Ruby Star Air Enterprise; KAF343 C-17A 41 Sqn, Kuwait AF; 97-0042 C-17A 164th AW; USAF. 2/8 ZM415 Atlas C1 70 Sqn, RAF; N739MA 737-8Q8 Miami Air. 3/9 07-0691 & 07-0821 U-28As 319th SOS, USAF both dep 6th. 4/8 88-2102 HC-130H 102nd RQS, NY ANG, escort to U-28As, dep 6th. **5/8 165093 C-20G VR-51, USN**. 6/8 162168 C-2A VRC-40, USN; 91-00516 RC-12X D/204th MIB, US Army n/s. 7/8 169036 C-40A VR-61, USN. 8/8 79-1712 KC-10A 305th/514th AMW, USAF dep 11th. **10/8 RA-76950 II-76TD-90VD Volga-Dnepr Airlines** dep 15th. 11/8 UR-CGV An-12BP Ukraine Air Alliance; 177705 CC-177 429 TS, RCAF; **C-GVFT RJ85 Comair firebomber routing Marseilles – Keflavik**. 13/8 01-0028 C-37A 310th AS, 6th AMW, USAF. 14/8 2-ODAY Challenger 601-3A; 85-0098 & 10-0260 C-12Vs Det 1, 2-228th Avn, US Army;

57-1474 KC-135R 909th ARS, USAF; HB-FSR PC-12 c/n 1729. 15/8 165829 C-40A VR-58, USN. 16/8 HB-FSO PC-12 c/n 1726. 17/8 **D-FIBE PC-6/B2-H4 based for surveys**; 14+01 Global 5000 FBS, German AF. 18/8 84-0210 & 90-1057 C-130Hs 142nd AS, 166th AW, De ANG; 4K-AZ100 II-76TD Silk Way Airlines; 15004 CC-150 437 TS, RCAF & 130336 KCC-130H 413 TRS, RCAF both support for **188749, 188750, 188770 & 188790 CF-18As 409 TFS, RCAF all dep 20th**. 20/8 130606 CC-130J 436 TS, RCAF; 58-0085 KC-135R 336th ARS, 452nd AMW, AFRC. 21/8 HB-FSW PC-12 c/n 1734. 22/8 HB-FSS PC-12 c/n 1730. 22/8 HB-IYZ RJ100 Swiss, last Swiss RJ flight, to hangar; ZZ178 C-17A 99 Sqn, RAF; ZZ343 Voyager K3 10/101 Sqn, RAF; 79-1710 KC-10A 305th/514th AMW, USAF n/s. 23/8 05-5142 C-17A 729th AS, 452nd AMW, AFRC; 177702 CC-177 429 TS, RCAF; 84-0188 KC-10A 305th/514th AMW, USAF n/s. 24/8 0001 Gulfstream G550 1 BLT, Polish AF dep 26th. 25/8 61-0294 KC-135R 77th ARS, USAF; 58-0102 KC-135R 465th AS, AFRC; 57-2597 & 64-14832 KC-135Rs 151st ARS, 134th ARW, Tn ANG; 57-1461 & 59-1463 KC-135Rs 173rd ARS, 155th ARW, Ne ANG; RA-76511 II-76TD-90VD Volga-Dnepr Airlines. 26/8 63-8039 KC-135R 465th AS, AFRC, 61-0318 KC-135R 1-6th ARS, AI ANG; HB-VXB PC-24. 27/8 91-1235 C-130H 165th AS, Ky ANG n/s; 177701 CC-177 429 TS, RCAF dep 31st. 28/8 HB-FSZ PC-12 c/n 1737. 29/8 15001 CC-150 437 TS, RCAF. 30/8 **YV3342 Citation 500 1**; 57-1436 KC-135R 151st ARS, Tn ANG n/s; 57-1519 KC-135R 174th ARS, Ia ANG n/s; UR-CEZ An-12BP Aerovis Airlines.

WICK

3/7 F-HPUR Hawker 800XP; N5152B P-51B Mustang n/s; N70ML Falconar F-12A Cruiser dep 5th. 7/7 HB-IUV Gulfstream G200. 8/7 F-GMPM Beech C.90A also 17th n/s. 9/7 PR-PHK Phenom 300 on delivery to RAF Cranwell, to become ZM333. 11/7 OO-145 Europa Europa n/s. 12/7 YR-TAR Citation 525 M2; **ZU-IHF Van's RV-10**. 14/7 D-EAWP Mooney M.20T. 15/7 **5Y-MOC Dash 8-315 Trident Aviation**. 16/7 C-GWRD Bell 429; SE-XXX Lancair IV; N162DE DHC-6-300 US Dept. of Energy dep 11/8. 19/7 HB-LUQ PA-31T Cheyenne 2; D-INFO PA-31T2 Cheyenne 2XL. 24/7 PH-GVH Lancair Super ES-DD. 25/7 **A6-CTA & A6-CTB Cirrus SR-22s**. 27/7 2-DARE PC-12; ZS-NTG PA-30-160; OE-FTP Phenom 100. 29/7 F-GRAJ PC-12.

Albatar Boeing 737-800, EI-IAS, departs Manchester Airport on October 18 with the SSC Napoli football team after the UEFA Champions League match with Manchester City. Ashley French



With thanks to: D Apps, D Banks, D Bougourd, S Boyd, J Brazier, N Burch, P Claridge, A Clarke, I Cockerton, KW Ede, M Farley, N French, P Gibson, D Graham, A Greening, J Gregory, G Green, I Grierson, D Haines, M Harper, K Hearn, G Hocquard, B Hunter, S Lane, G Morris, S Morrison, R Richardson, R Roberts, E Russell, RJ Sayer, M Shepherd, A Smith, D Turner, JA White, G Williams, Blackpool Aviation Society, Manston Movements, Solent Aviation Society/'Osprey', South Wales Aviation Group, CIAN, GSAE, The Aviation Society, EGPE ATC, www.dtmovements.co.uk, Aerodata Quantum Plus and RHADS.

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AIR BASE MOVEMENTS

A selection of the most interesting aircraft to visit air bases in the UK recently.



A 510th Fighter Squadron F-16CM Fighting Falcon on approach to RAF Lossiemouth, carrying an AQM-37 Jayhawk supersonic target drone. It was one of four from the USAF unit that detached to the Scottish base to take part in Exercise Formidable Shield. For more on this event see page 6. The F-16s were flown by pilots from the 40th Flight Test Squadron at Eglin AFB, Florida. Justin Ward

RAF BRIZE NORTON.

2/9 98-6006 C-32B 150th SOS, NJ ANG n/s also 5th.
7/9 5226/61-PL C-130H ET02.061, French AF. 8/9 554 A320-214 4 Sqn, Oman AF. 10/9 0453 C-295M 242. tsl, Czech AF; RA-82077 An-124-100 Volga-Dnepr Airlines. 12/9 UR-82027 An-124-100 Antonov Airlines. 15/9 UR-ZYD AN-124-100 Maximus Air Cargo n/s also 17th n/s & 20th n/s. 17/9 58-0100/D KC-135R 351st ARS, 100th ARW, USAF. 21/9 14-0028 A400M 221 Filo, Turkish AF n/s. 27/9 E163/705-RB & E171705-RZ Alpha Jet Es EAC00.314, French AF. 29/9 **SU-BAK C-130H Egyptian AF**; C-FDIJ 767-39HER/BDSF Cargojet n/s; 169228/QH KC-130J VMGR-234, USMC; A41-213 C-17A 36 Sqn, RAAF dep 1/10.

RAF CONINGSBY

4/9 51+05 Transall LTG63, German AF also 5th & 28th. 7/9 50+61, 50+74 & 50+88 Transalls LTG63, German AF. 8/9 46+46, 46+51 (dep 12th) & 46+57 Tornados ECRs TLWG51, German AF; 44+21 & 45+95 Tornado IDS TLWG51, German AF; 30+45, 30+47, 30+49, 30+51, 30+62, 31+20 EF-2000s TLWG73, German AF. 12/9 46+45 Tornado ECR TLWG51, German AF (the German AF Tornados and EF-2000s were present for Exercise Cobra Warrior that lasted three weeks). 15/9 30+46 EF-2000 TLWG73, German AF. 19/9 45+59 & 45+46 Tornado IDS TLWG51, German AF. 29/9 50+76 Transall LTG63, German AF.

RAF CRANWELL

6/9 G-CKIA/ZM311 & G-CKIB/ZM312 Prefect T1s arrived on delivery. 8/9 13-08436 CH-47F B/5-158 Avn, US Army. 25/9 G-BYUA, G-BYVJ, G-BYVX, G-BYWE & G-BYWT Tutor T1s dep on delivery to Finland. 26/9 E163/705-RB & E171705-RZ Alpha Jet Es EAC00.314, French AF.

RAF FAIRFORD

1/9 61-0029/BD B-52H 93rd BS, 307th BW, USAF dep 19th. 11/9 10-0222 C-17A 437th/315th AW, USAF. 12/9 99-0165 C-17A 445th AS, AFRC n/s; 86-0013 C-5M 436th/512nd AW, USAF n/s. 14/9 61-0020/20BS B-52H 20th BS, 2nd BW, USAF, 60-0021/LA & 60-0024/LA B-52Hs 96rd BS, 2nd BW, USAF all dep 29th. 19/9 80-1070 U-2S 99th RS, 9th RW, USAF dep 20th; 80-1087 U-2S 99th RS, 9th RW, USAF dep 22nd. 20/9 80-1085 U-2S 99th RS, 9th

RW, USAF dep 25th. 22/9 80-1090 U-2S 99th RS, 9th RW, USAF dep 4/10.

RAF LAKENHEATH

7/9 11-5725/FT HC-130J 71st RQS, USAF also 12th & 25th. 11/9 04-05419 & 04-05420 AH-64Ds A/3-159th Avn, US Army both o/s. 14/9 10-0217 C-17A 62nd/446th AW, USAF n/s. 19/9 07 blue C-27J TE, Lithuanian AF. 23/9 165829 C-40A VR-58, USN. 26/9 E171/705-RZ & E163/705-RB Alpha Jet Es EAC00.314, French AF both o/s; **12-1012 (n/s), 12-1017, 12-1027 (n/s), 12-1028 (n/s), 12-1030 & 12-1036 (n/s) F-15SAs Royal Saudi AF**. 30/9 **86-0187/SJ, 89-0488/SJ, 89-0495/SJ & 89-0501/SJ F-15Es 336th FS, USAF**. 20/9 04-4136 C-17A 305th/514th AMW, USAF n/s. 23/9 09-5711 & 14-5793 MC-130Js 9th SOS, 27th SOW, USAF both n/s.

RAF LOSSIEMOUTH

1/9 165829 C-40A USN also 11th. 5/9 140103 CP-140 RCAF. 15/9 10-0217 C-17A 62nd/4646th AW, USAF n/s. 21/9 168433 & 168763 P-8As USN; 84-0085 C-21A 76th AS, 86th AW, USAF.

RAF MILDENHALL

1/9 81-0941/JZ F-15C 122nd FS, La ANG n/s; **86-0148 159th FSW, FI ANG n/s**. 3/9 02-1105 C-17A 62nd/446th AW, USAF dep 7th. 7/9 11-5725/FT HC-130J 71st RQS, USAF n/s. 8/9 87-0035 C-5M 436th/512nd AW, USAF dep 11th. 15/9 86-0023 C-5M 433rd AW, AFRC. 18/9 00-0175 C-17A 97th AMW, USAF n/s. 18/9 73-1590/DM EC-130H 55th ECG, USAF n/s. 19/9 E128/705-TM Alpha Jet E EAC00.314, French AF n/s. 20/9 04-4136 C-17A

305th/514th AMW, USAF n/s. 23/9 09-5711 & 14-5793 MC-130Js 9th SOS, 27th SOW, USAF both n/s. 24/9 84-0061 C-5M 436th/512nd AW, USAF. 25/9 06-6161 C-17A 60th/349th AMW, USAF n/s; 93-0604 C-17A 89th AS, AFRC; 14-0028 A400M 221 Filo, Turkish AF dep 27th. 29/8 168763/LD P-8A VP-10, USN.

RAF NORTHOLT

3/9 013 C-295M 13.eltr, Polish AF. 5/9 95-00123 UC-35A E/1-214 Avn, US Army dep 7th. 9/9 MM62245 Falcon 900EX 31° St, Italian AF. 14/9 MM62029 Falcon 50 31° St, Italian AF. 15/9 84-0156 C-12U E/1-214 Avn, US Army. 16/9 04-05431 AH-64D 1-3 Avn, US Army & 13-08436 CH-47F B5-158 Avn, US Army both dep 19th. 17/9 016 C-295M 13.eltr, Polish AF.

RAF SHAWBURY

4/9 ZR283 AW139 202(R) Sqn, RAF n/s also 14th. 13/9 XX202 Hawk T1A dep to Leeming after storage. 14/9 ZZ418 Shadow R1 14 Sqn, RAF. 19/9 ZM510 & ZM513 Juno HT1s arrived on delivery to Ascent. 23/9 XW198 Puma HC1 arrived by road from Benson for storage. 26/9 ZZ388 Wildcat AH1 847 NAS, RN.

RAF VALLEY

1/9 ZZ515 Wildcat HMA2 825 NAS, RN. 19/9 161 Hawk Mk.166 Oman AF.

RAF WADDINGTON

8/9 58-0066 KC-135R 133rd ARS, NH ANG. 26/9 G-GMAD Beech 350C arrived on delivery to 14 Sqn, aircraft will be converted to Shadow configuration.

Key: n/s night stop; o/s overshoot

US Navy E-6B Mercury 162784 touching down at RAF Mildenhall. The aircraft arrived on October 20, flew a number of local missions and departed back to the US on the 29th. Matt Varley



DUTCH FREEDOM FIGHTERS

LOW-LEVEL STRIKERS

Ferry van der Geest tells **Tom Docherty** what it was like to fly the NF-5 in the Royal Netherlands Air Force.



The Freedom Fighter began arriving in the Netherlands as the 1960s closed. The type was designated in Dutch service as the NF-5A and B and pilots destined to fly the aircraft were sent to the US for training on a similar Northrop aircraft, the dual-seat T-38 Talon. Later, pilots were also sent to Canada.

One of the students who received initial instruction in America and then came back to put those skills into practice in the tense atmosphere of Western Europe was Ferry van der Geest.

Ferry, who went to the US as an officer cadet (Royal Netherlands Air Force rank Vaandrig) said: "For us students in 1979, the T-38 was the ultimate trainer...initially very difficult to handle because she responded to all inputs, but later in the programme we got used to her. For me, formation flying was the nicest thing to do with them. We made 120 hours, of which 20 were flown solo; and also a solo low-level navigation trip."

For NF-5 pilots, the next stage was to complete the conversion in the Netherlands with 313 Squadron, the Operational Conversion Unit (OCU) which was at Twente. The unit had re-formed in 1972 with the NF-5A and B and was one of the famous NATO 'Tiger' squadrons.

Ferry recalled training at Twente: "After graduation we went back to Holland to our

Above: Based at Twente, 313 Sqn took over responsibility from 315 Sqn for the operational conversion of pilots returning from advanced training in the US and Canada. An NF-5A of 313 Sqn is seen touching down at the base.

Peter R Foster

theatre operational conversion course where we were introduced to the NF-5A and B models. Since we had the T-38 time, this transition proved to be reasonable easy.

"We had to get used to external stores, a bit more power and adverse weather in Holland. We also had to learn how to use the jet as a weapons platform."

INTERDICTION

On completion of the course Ferry was posted to 316 Sqn, which was equipped with 22 NF-5A and Bs, based at Gilze-Rijen. The NF-5's role was as a fighter-bomber, though for a brief period they were also used as day interceptors armed with AIM-9J Sidewinder missiles for a few months in early 1982, during the phase-out of Lockheed F-104G Starfighter, which was being replaced by the General Dynamics F-16 Fighting Falcon.

The squadron's role was to interdict any Warsaw Pact aggression coming through West Germany in the event of the Cold War becoming hot. It meant the pilots spent most of their operational training time over the border in West Germany, operating at low level.

Ferry recalled: "I then moved on to 316 Squadron at Gilze-Rijen in 1981 for the advanced operational course. Here we flew in the squadron as young wingmen.

"All-in-all, the NF-5 was an easy airplane to fly, very forgiving and she handled easier than the T-38 while flying close formation...a bit more stable, if you will. The NF-5 was a feisty little fighter-bomber, and ideal for close air support [CAS] missions in the European theatre.

"All, or most, training sorties were flown at low level in [West] Germany and that meant either at 500ft above ground level [AGL] or 250ft AGL in the designated low-fly areas. The NF-5's were primarily used for CAS but also on battlefield air interdiction [BAI] and offensive counter air [OCA] missions [attacks on airfields]."

He said CAS was always carried out with a forward air controller (FAC), either on the ground or in the air. On land they mostly were commandos and in the air usually highly skilled helicopter pilots.

The weapons were generally the Mk 82 Snake Eye bombs, and sometimes BL755 cluster bombs, depending on the target. The twin-engined NF-5 could carry two of these weapons under each wing. On simulated war missions, two 275 US gal (1,041 lit) tanks were carried under the wings and on some missions an additional centreline tank (150 US gal/568 lit) was carried. In all, the F-5 ►

Royal Netherlands Air Force pilots in discussion next to NF-5B K-4014 of 314 Sqn. This aircraft went on to serve with the Turkish Air Force (Türk Hava Kuvvetleri), one of six of the type acquired from the Dutch.

Key Collection



In the mid-1980s, an experiment involving three new camouflage schemes was undertaken: overall grey, a two-tone grey/blue and a scheme named 'F-16'. The overall grey was finally selected as seen on this NF-5B of 313 Sqn in 1986. The unit took over from 315 Sqn providing the theatre operational conversion course and also assumed the advanced operational course from 316 Sqn. TGD



had seven hardpoints, two on the wing tips for missiles/fuel tanks; four under wings, two of which were plumbed for fuel, and one under the centreline, also plumbed for fuel. A combination of rockets, missiles, bombs and drop tanks could be carried.

"This made the bird very heavy," Ferry explained, "and on summer days take-off runs with these configurations were 'sporty', to say the least."

An engine failure at low level, with the weight of the wing tanks, could be fatal, so to maintain height on a single engine it was necessary to get rid of them immediately.

In addition to external stores, the aircraft had two 0.50 Browning guns in the nose, used for strafing and self-defence if a Warsaw Pact intruder attacked.

The jets were initially delivered without any electronic countermeasures (ECM)

equipment, but in the mid-1970s the Dutch developed chaff/flare dispensers, constructed on the aft upper fuselage. Some basic radar warning gear was installed.

Ferry continued: "Simulated CAS missions were always flown within 2 ATAF [Second Allied Tactical Air Force] but in support of the Dutch Army 1 Corps in the Lower Saxony Plain. Since CAS was performed in a relatively small part of

An NF-5A of 314 Sqn in landing configuration and carrying large underwing fuel tanks. Peter R Foster





A 315 Sqn NF-5B seconds from touchdown. This squadron was the first to be transferred to the NF-5 in December 1969 and was based at Twente. Peter R Foster

NF-5s IN THE NETHERLANDS

The prototype Northrop F-5, the N156F, first flew at Edwards AFB, California, on July 30, 1959, and exceeded the speed of sound on its first flight. The aircraft was developed into the single-seater F-5A Freedom Fighter.

A two-seat version was designated F-5B. The second-generation F-5, the F-5E/F Tiger II, was introduced in 1972. In addition to the airframes constructed by the parent company, several hundred were built under licence by Canadair, where it was designated CF-5A and CF-5B. It was the Canadair-built aircraft that equipped

squadrons of the Royal Netherlands Air Force, the Koninklijke Luchtmacht (KLu), the first aircraft going to 315 Squadron in December 1969. The Dutch designated the type the NF-5A and B.

The Netherlands procured 75 NF-5As and 30 NF-5Bs.

During service with the KLu, the NF-5s had several upgrades including a strengthened canopy to cope with the high number of bird strikes, new avionics, ALE-40 chaff and flare dispensers mounted on the rear fuselage and Radar Warning Receiver (RWR) devices on the tail.

In addition to 313 and 316 Sqn, several other units operated the NF-5: 314 and 315 Sqn and Testgroep Vliegtuigbeproevingen NF-5 (a field technical training unit). No.316 Sqn had been formed by splitting 314 in 1971.

In 1988, 313 Sqn disbanded and 314 Sqn operated NF-5s until May 1990.

Crews at 315 Sqn began to convert to the F-16 in 1986 and the last squadron to operate the NF-5 in Dutch service was 316 which made the last flight of the type on March 15, 1991 ending 22 years' service for the NF-5.

The 'F-16' camouflage was worn by 315 Sqn NF-5As in the 1980s. The squadron originally had 45 NF-5As and 'Bs but this was reduced to 31 of both variants in 1972 when the operational training was transferred to 313 Sqn. TGD



airspace, we usually flew two ships on these missions. Lead, or Alpha as they were called, would bring in his Bravo in minimum ingress formation. This means the second ship would be somewhere astern, about 200 to 300 yards, and he would manoeuvre his jet into a delivery position under direction of the FAC. [He would then] pick out the target and deliver the weapons – then get the hell out of 'Dodge'.

"Directly after the delivery, the Bravo would proceed to fluid formation, meaning one-mile abreast, in order to be able to check the leads six [the area behind/above/below the leader's aircraft for any threats he would be unable to see].

"All ingress manoeuvres where flown at treetop level in wartime, but 250 or 500ft in peace time or exercises.

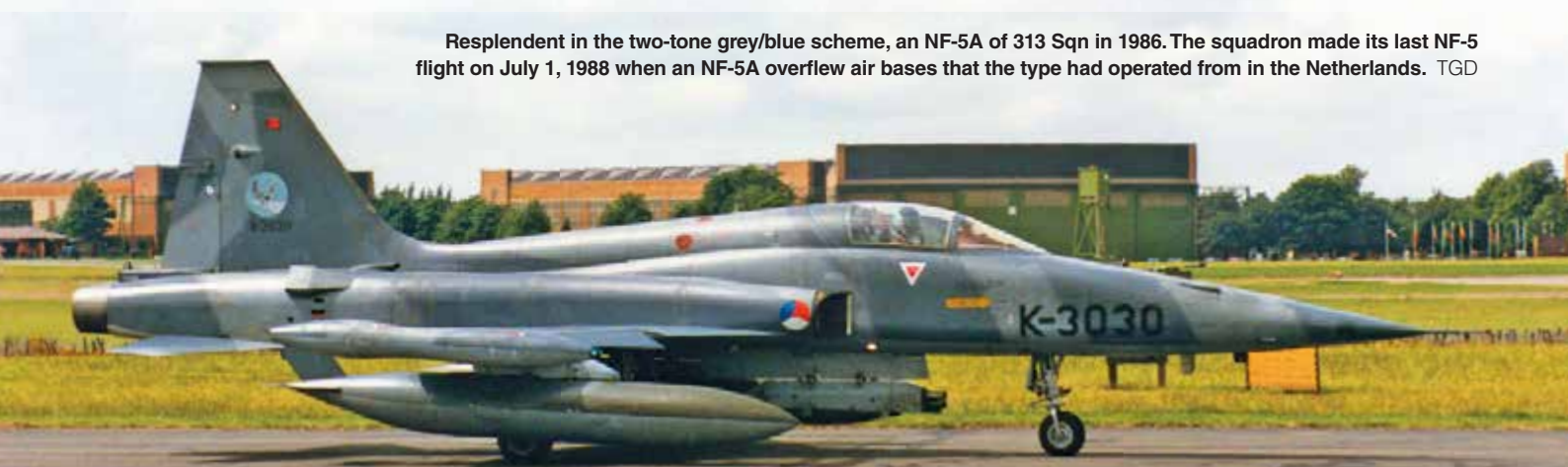
"Before any attack, we would pitch up to

an apex of around 1,500 to 2,000ft, and then acquire the target and release weapons.

"As one can imagine, it could be very busy in [West] Germany during NATO manoeuvres and even on routine days with good weather, many jets from all NATO partners were flying around, sometimes culminating in dogfights.

"For me as a 21-year-old 'kid' a complete new world opened when I arrived back in Holland and met European weather and ►

Resplendent in the two-tone grey/blue scheme, an NF-5A of 313 Sqn in 1986. The squadron made its last NF-5 flight on July 1, 1988 when an NF-5A overflew air bases that the type had operated from in the Netherlands. TGD



rules. It is no surprise that in those days many pilots crashed and died due to lack of experience and many times due to bad weather in the target area, where spatial disorientation was lurking. It was an inherently dangerous, but, fantastic job!

"Our little feisty Northrop was made for these jobs. She was easy to handle, had no bad manners, and, as with every fighter, one should not press her limits. And even then the jet was very docile, still steerable with her ailerons when fully stalled."

The manoeuvring flaps on the NF-5 were fantastic, he said, operated by a simple switch on the inner throttle.

"Any time we started manoeuvring with less than 420kts these devices were used, and they made our lives very comfortable," Ferry continued. "The NF-5A had a very long nose. In the landing phase one could hardly see the runway. Navigating the NF-5 was made reasonably easy because we had a Doppler system with a rolling map in the cockpit and as long one stayed in the swathe of the map, there were no problems.

"Each mission was carefully planned. With CAS we only carried the staff map with a general target area in it, so once there we would find our way around visually and for me as a young 'wingie', my sole responsibility was to stay in formation with my leader and drop the ordnance on his call. We usually cruised at 360kts and attacked with 420 to 450kts."

Missions were usually organised by both pilots, the leader planning the actual attack, and the Bravo checking navigation warnings, target weather and usually the route in and out. Everything was put together, briefed, and flown. "We operated from hardened aircraft shelters [HAS], so most of the time we met at the runway and then Bravo would take his position on the wing," Ferry explained.

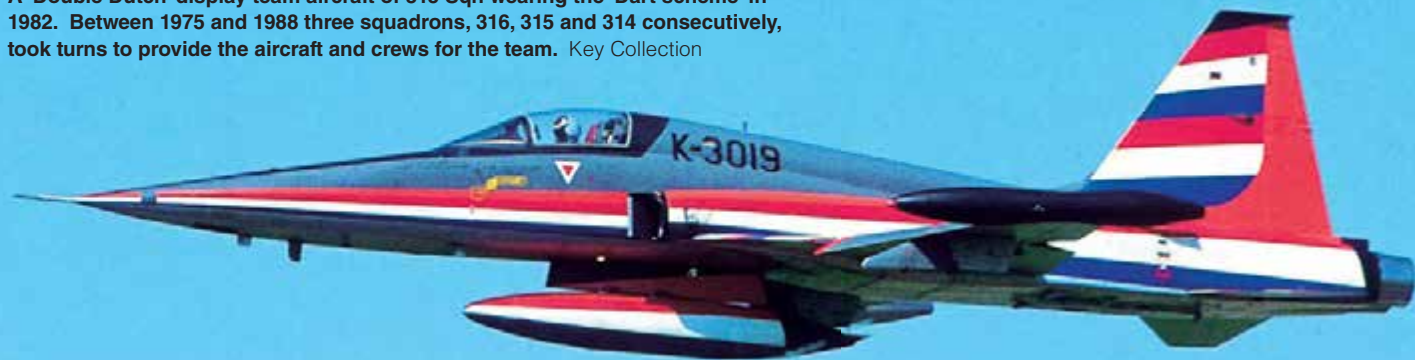
Most take-offs were made in close formation. When airborne Bravo would either move to normal ingress formation, 300 yards out on a 45° line, or to fluid, abreast, one mile. It was sometimes hard to stay in formation with adverse weather, and especially not lose sight of the leader.

"In Holland, 1,000ft AGL was the minimum height we were allowed to fly, but once we crossed the German border all the fun would start, descending to low level. Then, approaching the target area, the FAC was contacted on UHF and from then on he directed us to the target. Sometimes these targets were very hard to find; tanks or APCs [armoured personnel carriers] hidden under trees, and again my only responsibility was to stay close to the leader, follow him all the way and then drop the stuff on his call, making my own acquisition in the last seconds.

"After that we would egress as fast and low as we dared; then we would pick up our route home. If there was fuel left, often a practice diversion was made on one of the many NATO bases around, and then we pressed home back to Gilze-Rijen. The mission was finished with one or two touch-and-goes, then a full stop, followed by a debrief with coffee."

After his time on the NF-5, Ferry went on to fly the Starfighter and Fighting Falcon accumulating 1,300 hours in fast jets. **AN**

A 'Double Dutch' display team aircraft of 315 Sqn wearing the 'Dart scheme' in 1982. Between 1975 and 1988 three squadrons, 316, 315 and 314 consecutively, took turns to provide the aircraft and crews for the team. Key Collection



The next issue will be an RAF 100th Anniversary special and will be on sale on December 14, 2017*

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December 2017
Volume 79 No 12.

Founded in 1939 as
Air Defence Cadet
Corps Gazette.

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www.aviation-news.co.uk

DESIGN: Froggatt Designs

COVER DESIGN: Steve Donovan

PRODUCTION MANAGER: Janet Watkins

ADVERTISING AND COMMERCIAL:
Commercial Director: Ann Saundry

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Aviation News incorporating Jets (ISSN: 2047-7198), is published monthly by Key Publishing Ltd, PO Box 100, Stamford, Lincs, PE9 1XQ, UK and distributed in the USA by UKP Worldwide, 3390 RAND ROAD, SOUTH PLAINFIELD, NJ 07080. Periodicals postage paid at RAHWAY, NJ AND AT ADDITIONAL MAILING OFFICES.

POSTMASTER: Send address changes to: Aviation News incorporating Jets, Key Publishing Ltd C/O 3390 RAND ROAD, SOUTH PLAINFIELD, NJ 07080.

DISTRIBUTED BY: Seymour Distribution Ltd, 2 Poultry Avenue, London, EC1A 9PP, UK. Tel: +44 (0)20 7429 4000 Fax: +44 (0)20 7429 4001



PRINTED BY: Warner's (Midland) plc, The Maltings, Bourne, Lincs. PE10 9PH

KEY PUBLISHED MONTHLY BY: Key Publishing Ltd, address as Editorial. Printed in England ISSN 2047-7198

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It is hard to believe that 25 years have passed since the RAF retired its 'Phinal Phantom', in October 1992. Considering it was an aircraft the RAF never really wanted, the Phantom went on to have a distinguished air force career. But all things come to an end, and in 1992 the last examples were flown into retirement, with the majority of them succumbing to the scrapper's axe. This 100-page special is a eulogy to the British Phantom, one of the most loved fighter aircraft to ever serve with the British military.

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Air Commodore Rick Peacock-Edwards CBE AFC FRAeS FCIM flew the English Electric Lightning, McDonnell Douglas F-4 Phantom and Panavia Tornado F.2/F.3 during a stellar RAF career. He explains to Steve Bridgewater why the Phantom was a real war machine.

A MONTH ON THE FRONT LINE

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